December

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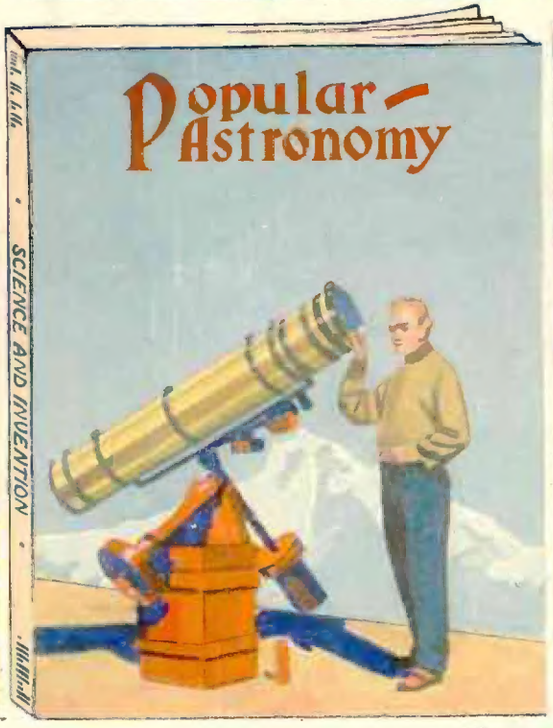
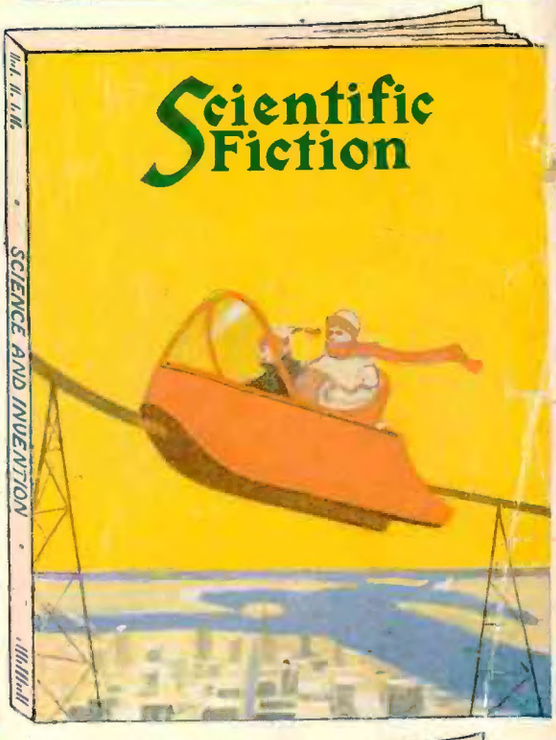
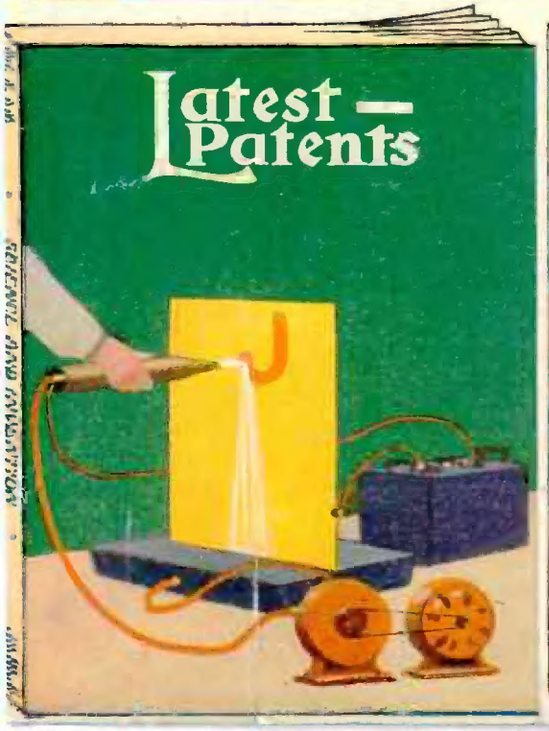
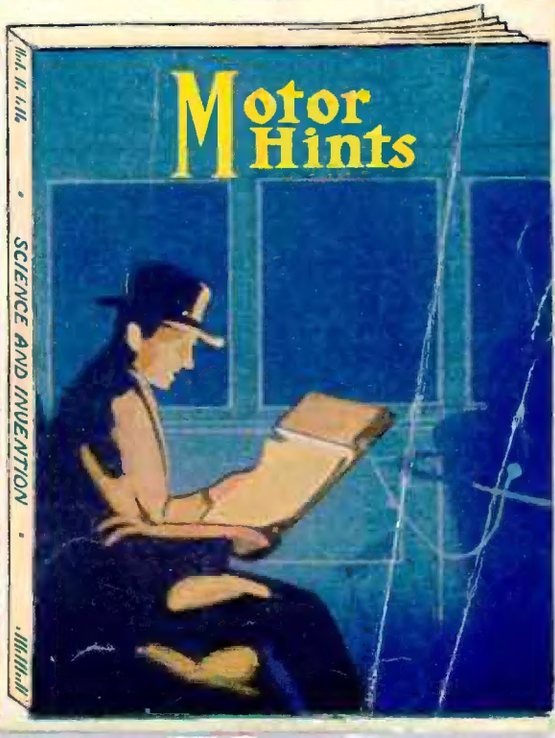
Science and Invention









FREE Send for this Book

Learn How to Earn $3,500 to $10,000 a Year

I Will Train You at Home in Your Spare Time to Earn $3,500 to $10,000 a Year as an Electrical Expert

L. L. COOKE

This Big Free Book will show you how you, too, can learn to earn this fine big pay, as an Electrical Expert in the World's Greatest Industry. Send for your copy now. Learn all about the growth and future of electricity—all about the big jobs that are open now and how I can quickly fit you to earn $3,500 to $10,000 a year.

Prepare for a Big Job—Make Extra Money While You Are Learning

Trained "Electrical Experts" are in great demand at the highest salaries, and the opportunities for advancement and a big success in this line are the greatest ever known. "Electrical Experts" earn $70 to $200 a week. Fit yourself for one of these big paying positions and make extra money in your spare time after the first few lessons are finished.

Easy to Earn $12 to $30 a Day

Today even the ordinary Electrician—the "screw driver" kind—is making money—big money. But it's the trained man—the man who knows the whys and wherefores of Electricity—the "Electrical Expert"—who is picked out to "boss" ordinary Electricians—to boss Big Jobs—the jobs that pay. You, too, can learn to fill one of these jobs—spare-time only, is needed. Be an "Electrical Expert"—Earn $70 to $200 a week.

SUCCESS SHOTS

What I Have Done for Other Men

"Made $284.00 clear profit in spare time work while studying with you."
F. Fritchman,
1176 E. 178th St.,
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"In business for myself. Clearing over $750.00 a month. Some jump from $30.00 a week."
W. E. Pence,
Chehalis, Wash.

"Made $750.00 in spare time work while studying your course. Gone into business now."
John J. Burke,
4330 E. Lombard St.,
Baltimore, Md.

"Am making over $600.00 a month now. $75.00 was my limit before I took your course."
A. Schreck,
Phoenix, Ariz.

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You don't have to be a College Man; you don't have to be a High School graduate. If you can read and write English, my course will make you a big success. It is the most simple, thorough and successful Electrical Course in existence, and offers every man, regardless of age, education or previous experience, the chance to become, in a very short time, an "Electrical Expert," able to make from $70 to $200 a week.

I Give You A Real Training

As Chief Engineer of the Chicago Engineering Works, I know exactly the kind of training a man needs to get the best positions at the highest salaries. Hundreds of my sudents are now earning $3,500 to $10,000 a year. Many are successful ELECTRICAL CONTRACTORS.

Your Satisfaction Guaranteed

So sure am I that you can learn Electricity—so sure am I that after studying with me, you too can get ino the "big money" class in electrical work, that I will guarantee under bond to return every single penny paid me in tuition if, when you have finished my course you are not satisfied it was the best investment you ever made.

FREE Electrical Outfit and Radio Course

I give each student a Splendid Outfit of Electrical Tools, Materials and Measuring Instruments absolutely FREE. I also furnish them with all supplies, including examination paper, and many other things that other schools don't furnish. You do PRACTICAL work—AT HOME with this Outfit. You start right in after the first few lessons to WORK AT YOUR PROFESSION in a practical way.

Get Started Now—Mail Coupon

I want to send you the "Vital Facts" of the Electrical Industry, including my Electrical Book, Proof Lessons and a sample of my guarantee bond all FREE. These cost you nothing and you'll enjoy them. Make the start today for a bright future in Electricity. Send in the coupon—NOW.

L. L. Cooke, Chief Engineer, Chicago Engineering Works
Dept. 29 **2150 Lawrence Ave. Chicago, Ill.**

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2150 Lawrence Ave., Chicago, Ill.

Dear Sir:—Send at once your "Big Book of Electrical Facts," including the Free Radio Course Sample Lesson and full particulars of your Free Outfit and Home Study Course—all fully prepaid, without obligation on my part.

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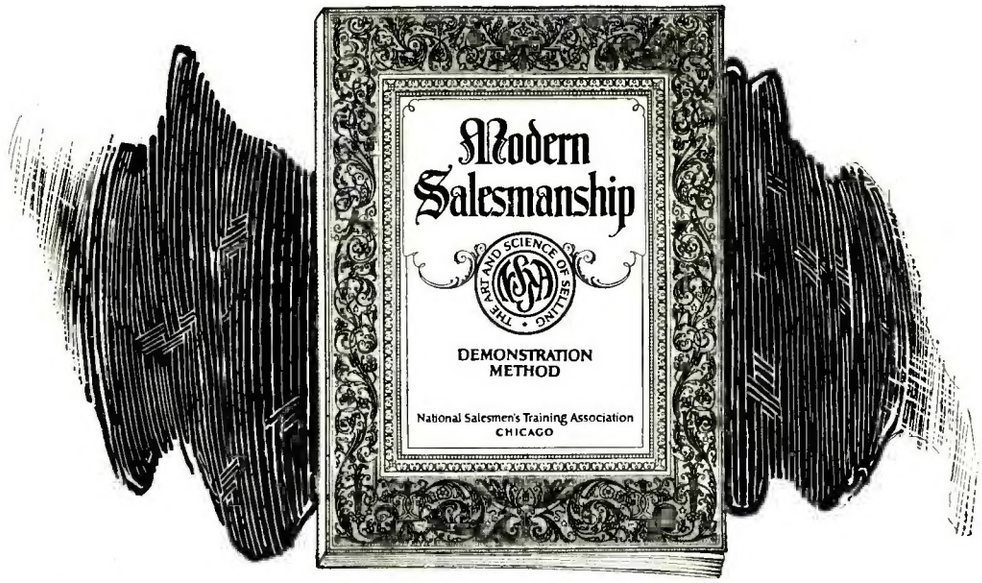

NOW FREE!

The Book That Has Shown Thousands the Way to Amazing Salary Increases

Do you want to leave the rut of routine work and start right out making more money than you ever dreamed possible? We have done exactly this for thousands of men. Here is the book which gave them their start. Read how it is now offered to you—FREE!

TAKE this situation: A man who had worked all his life in a routine job at low pay suddenly surprises his friends, by moving into a better neighborhood, taking a big house, buying a car and blossoming out as a well-to-do and influential citizen in his new community. How did he do it? What is the secret that he used? Simple enough. He knew that the biggest money in business is in Selling, and though he felt that he couldn't sell a thing, he suddenly learned the secrets that make Master Salesmen and then began to make big money.

If only one man had found inspiration enough in this remarkable book to jump to a sudden brilliant success in the Selling field—into a job paying him many times his former salary—then you might call it luck. But thousands have done it.

READ!

Charles Beery of Winterset, Iowa, stepped from $18 a week as a clerk to a position making him $1,000 the very first month. J. P. Overstreet of Dennison, Texas, read this amazing book, left a job on the Capitol Police Force at a salary of less than $1,000 a year and in six weeks earned $1,800. F. Wynn, Portland, Ore., an ex-service man, earned $554.37 in one week. Geo. W. Kearns of Oklahoma City found in this book a way to jump his earnings from $60.00 a month to $524.00 in two weeks, and C. W. Campbell learned from it how he could quit a clerking job on the railroad to earn $1,632 in thirty days.

Your One Chance to Make the Biggest Money of Your Life

Not one of the men whose names appear in the panel at left had ever sold a thing before—not a dime's worth. Yet every one of these men, through reading this book, discovered an amazingly easy way to jump suddenly from low pay to extraordinary earnings in the Selling field.

Sounds remarkable, doesn't it? Yet there is nothing remarkable about it. There are certain ways to approach different types of prospects to get their undivided attention—certain ways to stimulate keen interest—certain ways to overcome objections, batter down prejudices, outwit competition and make the prospects act.

Simple as A B C

"Modern Salesmanship" tells exactly how the National Salesmen's Training Association will teach you these principles in your spare time at home.

As soon as you are qualified and ready, the Association's Employment Service helps you to select and secure a selling position as city or traveling salesman.

Now Free to Every Man Who Will Act at Once

We are not making any extravagant claims about what we will do for you. We don't have to. All of the amazing proof and many important features about Salesmanship are contained in our new salary-raising book, "Modern Salesmanship." It is yours—FREE. Send the coupon for it today. It will show you how you can quickly become a Master Salesman—a big money maker. It will tell you about the National Salesmen's Training Association system of Salesmanship training—about the National Demonstration method that gives you actual experience while studying—and all about the amazing opportunities that await you in the Selling field.

This may be the one big chance of your life to leave forever behind you the low pay of a routine job for a sudden, brilliant success at a big salary.

Is it worth 2c. to find out? Then mail this coupon NOW.

National Salesmen's Training Association

Dept. 42-W, Chicago, Illinois

National Salesmen's Training Association
Dept. 42-W, Chicago, Ill., U. S. A.

Please send me, without any obligation on my part, your free book, "Modern Salesmanship," and full information about the N. S. T. A. system of Salesmanship Training and Employment Service. Also a list showing lines of business with openings for salesmen.

Name.....

Street.....

City..... State.....

Age..... Occupation.....

Vol. X
Whole No. 116

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FORMERLY

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No. 8

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Table of Contents for December

POPULAR SCIENTIFIC ARTICLES

EDITORIAL ... 737
By H. Gernsback
FUTURE AIR TRAFFIC ... 738
By H. Gernsback
MOUNTAIN AIR PIPED TO CITY ... 739
By Joseph H. Kraus
THE MONSTER—SCIENCE PLUS DRAMA ... 740
"DUMMY OBSERVER" FOR AIRPLANES ... 741
By Ernest Jones
AN INTERVIEW WITH THE LADY EDISON ... 743
TRANSMITTING NIAGARA POWER BY RADIO ... 744
WONDERS OF THE SEA ... 746
By A. P. Peck
1,000,000 VOLT DISCHARGES ... 747
THE WARSHIP OF 1950 ... 749
By Graser Schornstheimer, Naval Expert
DR. HACKENSAW'S SECRETS—No. 11—A JOURNEY TO THE YEAR 2025 ... 750
By Clement Fezandié
THE AUTOBIOGRAPHY OF AN EXPLOSION ... 751
By Prof. Lindley Pyle
PILOT-LESS MAIL PLANES ... 752
By H. Winfield Secor, Associate Member, American Institute of Electrical Engineers
600,000 VOLT TRANSMISSION LINE ... 754
NEW AND USEFUL DEVICES ... 754
WORLD'S LARGEST SPEECH AMPLIFIER ... 755
NEW SCIENCE WRINKLES ... 755
PROJECTING OPAQUE OBJECTS IN A LIGHTED ROOM ... 756
By E. Weiss
HIGHEST VOLTAGE TRANSFORMER ... 756
A FUTURIST MUSIC BOX ... 756
By Alexander H. Kolbe
BUILDING YOUR OWN REFLECTING TELESCOPE ... 758
By C. E. Barns
THE AMATEUR MAGICIAN ... 759
By Joseph H. Kraus

PRIZE CONTESTS

"COMBINATION CONTEST" AWARDS ... 757
MOTOR HINTS—$50.00 IN PRIZES MONTHLY ... 760
HOW-TO-MAKE-IT DEPARTMENT—$30.00 IN PRIZES MONTHLY ... 766
WRINKLES, RECIPES AND FORMULAS—Edited by S. Gernsback ... 767
"RADIO INTERFERENCE" CONTEST ANNOUNCEMENT—$100.00 IN PRIZES ... 771

AUTOMOBILES

SIMPLE NEW LOCK FOR FORD CARS ... 755
MOTOR HINTS—$50.00 IN PRIZES MONTHLY ... 760
AUTOMOBILE RADIO ... 768

ELECTRICITY

THE MONSTER—AN ELECTRICAL DRAMA ... 740
"DUMMY OBSERVER" FOR AIRPLANES ... 741
By Ernest Jones
TRANSMITTING NIAGARA POWER BY RADIO ... 744
1,000,000 VOLT DISCHARGES ... 747
THE AUTOBIOGRAPHY OF AN EXPLOSION—Written by Piezo-Electricity ... 751
By Prof. Lindley Pyle
PILOT-LESS MAIL PLANES ... 752
By H. Winfield Secor
600,000 VOLT TRANSMISSION LINE ... 754
REVOLVER FLASHLIGHT ... 754
WORLD'S LARGEST SPEECH AMPLIFIER ... 755
HIGHEST VOLTAGE TRANSFORMER ... 756
THE AMATEUR MAGICIAN ... 759
By Joseph H. Kraus
MOTOR HINTS—$50.00 IN PRIZES FOR ELECTRICAL IDEAS ON MOTOR CARS ... 760
HOW-TO-MAKE-IT DEPARTMENT—$30.00 IN PRIZES MONTHLY ... 766
LATEST PATENTS ... 778
THE ORACLE—QUESTION AND ANSWER BOX ... 779
PATENT ADVICE—Edited by Joseph H. Kraus ... 801

RADIO ARTICLES

RADIO RACE HORSE ... 768
AUTO HAS CONCEALED RADIO ANTENNA ... 768
BROADCASTING NIAGARA'S ROAR ... 769
SEVENTH PRIZE RADIO RECEIVING SET ... 770
By George Goga
"RADIO INTERFERENCE" CONTEST ANNOUNCEMENT—$100.00 IN PRIZES ... 771
MAKE YOUR OWN RADIO MOVIES ... 771
RADIO TUNING DEVICES AND CIRCUITS ... 773
By A. P. Peck
RADIO BROADCAST STATION PHOTOS ... 774
RADIO BROADCAST—LIST OF LATEST RADIOPHONE BROADCASTING STATIONS AND CALL LETTERS ... 775
RADIO FOR THE BEGINNER—TENTH INSTALLMENT ... 776
By Armstrong Perry
RADIO ORACLE ... 777
LATEST PATENTS ... 778

CHEMISTRY

PRACTICAL CHEMICAL EXPERIMENTS—PAPER No. 8—QUALITATIVE ANALYSIS ... 761
By Prof. Floyd L. Darrow
SIMPLE CHEMICAL LABORATORY ADJUNCTS ... 764
By Raymond B. Wailes
WRINKLES, RECIPES AND FORMULAS—Edited by S. Gernsback ... 767
LATEST PATENTS ... 778

CONSTRUCTOR ARTICLES

BUILDING YOUR OWN REFLECTING TELESCOPE ... 758
By C. E. Barns
SPATTER WORK—HOW IT IS MADE ... 763
By Dr. Ernest Bade
SIMPLE CHEMICAL LABORATORY ADJUNCTS ... 764
By Raymond B. Wailes
THOSE DEADLY DYNAMITE CAPS ... 764
By Dale R. Van Horn
HOW TO MAKE AN ACCURATE PANTOGRAPH ... 765
AUXANOMETER MEASURES ELECTRIFIED PLANT GROWTH ... 765
By Walter E. Burton
SEVENTH PRIZE RADIO RECEIVING SET ... 770
By George Goga

ASTRONOMY

BUILDING YOUR OWN REFLECTING TELESCOPE ... 758
By C. E. Barns

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"The Real Secret of Selling Jumped Me Out of That!"

"I used to slave there—keeping books—in that little general store. How I used to envy the traveling men who sold goods to old Barthell! They traveled first class; stopped at the best hotels; enjoyed fine incomes. But I never dreamed that I too could earn big money selling, until—shall I tell you what woke me up?"

"EVERY time I go through this little town on my trips, I thank my stars that I wasn't totally deaf when opportunity knocked, for now I'm making—every week—over ten times the amount Barthell used to pay me on Saturday night when the store closed.

"My employer was very opinionated and unprogressive. He was an extremely close, cautious buyer, and it used to be my delight to listen to the different selling talks that the traveling men used in their attempts to sell goods to him.

"Some of these salesmen were just 'order-takers.' They were entirely at Barthell's mercy. If he happened to need something in their line, and felt disposed to give a little order, this type of man got it. But if Barthell made any objections to buying, these 'order-taking' salesmen were seldom, if ever, able to meet and overcome his resistance. I thought, even then, that I could do better than these fellows did—for often there was no real reason for their failure to make sales to Barthell. Frequently the store actually needed the goods they offered, and he refused to buy simply because the salesman 'rubbed him the wrong way.'

"At these times I sat on my high stool listening, and after the man had left without an order, I would imagine what I might have said and done, if I had been in that salesman's place, to remove the obstacles that had prevented his sale.

"But there were a few other salesmen who rarely left the store without an order. They had the ability of making even cunning old Barthell really want their goods—and they made him want to buy from them!

"There was one man in particular—James Neal his name was. He was a regular hero in my eyes, for no matter how Barthell felt about buying, Jimmie Neal never failed to get his name on the 'dotted line' before he left, and it was usually a good-sized order. Sometimes he did it one way, and sometimes in another, but he always did it. Objections always vanished as soon as made, and when Neal finally said, 'Sign right here, Mr. Barthell!' Barthell unhesitatingly obeyed.

"If Barthell was doubtful and pessimistic about his business, Neal left him full of enthusiasm and renewed confidence, for Neal often suggested really helpful plans for increasing the sales of the store, and when they were carried out they always worked well. I got to feeling as if Jimmie Neal was really running the store! He was certainly a master salesman. I admired and envied him extravagantly—and the desire grew upon me to imitate him, to be a successful salesman—to travel and meet interesting people—to see the country—stop at big city hotels—to enjoy a real income instead of the pittance I was receiving.

"I thought it was a wild, hopeless wish, but one day, after Neal had sold Barthell his customary large bill of goods, I drew him aside, told him what I wanted to do, and hesitatingly asked him if he thought I was cut out for a salesman. I told him I felt sure I could do better than some of the 'order-takers' who came, for they never removed a single one of Barthell's objections to buying and——

"'You've hit it exactly!' Neal interrupted. 'You've almost hit upon the real secret of selling. Few fellows know it, but it can be learned—easily. I used to be an "order-taker," too—before I learned it. If you've guessed as close as you did just now, you won't have any trouble in learning it either. If you want to sell goods, and make big money at it, let me start you right by telling you about the man who will teach you the inside methods of the fellows who are in the 'five-figure class.'

"Would I let him? I was all ears! And then it was that I first heard of Arthur Newcomb—and his amazing method of teaching—not just Salesmanship — but Super-Salesmanship. This course of Newcomb's is rightly called 'Super-Salesmanship'—because it goes beyond and above all the old traditional theories of persuasion. To be sure some of these theories were used to good effect, because they were partially true. But they did not go far enough. Mr. Arthur Newcomb, so Neal said, had found, after years of study, the great fundamental principle of selling from which these theories came. Mr. Newcomb has employed and trained hundreds of salesmen and knows exactly the problems salesmen must solve and how to solve them.

"Well, you can imagine how eager I was to get Newcomb's Course in Super-Salesmanship! I sent off for it right away, and from the moment I read the first page, my confidence in my ability to make good at selling grew.

"Within a month I gave up my position, much to Barthell's disgust, and went to Chicago. Then I answered the 'Salesmen Wanted' ads, until I landed a job, selling builders' hardware. Thanks to the wonderful principle of Super-Salesmanship I had learned from Mr. Newcomb's course, I got good-sized orders, even on my first trip. I rarely had any trouble in making sales, for I had learned how to handle all sorts and kinds of customers. The cold-mannered men, the conservative, the aggressive, the cautious, the miserly, the high-tempered, the irritable, the argumentative, the cunning, the pessimistic, the doubting, the indifferent, the suspicious, the 'too-busy' men, the postponing kind—I found that the real secret of selling worked almost equally well on all of them.

"Trip by trip, and month by month, my sales and my income from selling grew. I don't like to boast, but Jimmie Neal was right when he said that Newcomb's course would show me the inside secrets of the 'five-figure men.' Last year my income was well over $10,000, and now that general business is getting better, I expect to jump it $2,000 or $3,000 this year.

"And, like Jimmie Neal, I can't say enough for Newcomb's Super-Salesmanship. Any young fellow who wants to get into the big money selling class by the rapid-transit route will save himself years by getting this course right off the bat in the beginning."

It gets down to brass tacks at once. You have something to sell. You must make the other man buy. There is one way to do it. Arthur Newcomb shows you the way. You sell your product. No preaching, no theorizing, no tricks, no stunts. Just the one clean-cut, easily understood principle, and its hundred and one applications that will speedily get you under, over, around and through the obstacles to triumphant selling achievement. You need not take anyone else's word for what the One Great Rule will do for you. You can be the judge yourself. Send no money. Merely mail the coupon or write a letter, and the complete course will be sent, all charges prepaid, at once, so that you may take advantage of the special price and save $2. If you are not entirely satisfied, send it back any time within five days after you receive it and you will owe nothing.

On the other hand, if you are pleased as the thousands of other men and women who have used the course, send only $3 in full payment. You take no risk and you have everything to gain, so mail the coupon now before this remarkable offer is withdrawn. Independent Corporation, Dept. S-11012, 15 West 37th St., New York City.

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Gentlemen — Please mail me the Newcomb Course "Super-Salesmanship" for 5 days' free trial. If I decide to keep it, I will remit $3, the Special Price. Otherwise I will return it to you. It is understood that this coupon puts me under no obligation whatsoever.

Name.....

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Sci. & Inv. 12-22

A Chemistry Laboratory for $7.00

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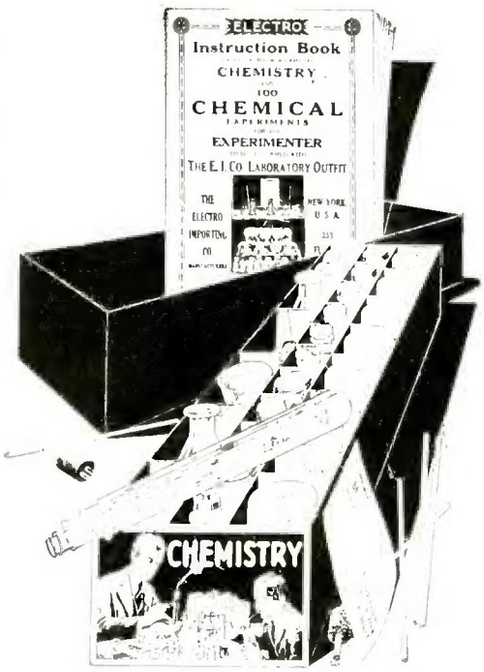
This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive amusing experiments.



DESCRIPTION OF THE OUTFIT

The outfit consists of forty-four (44) chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers, and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each.

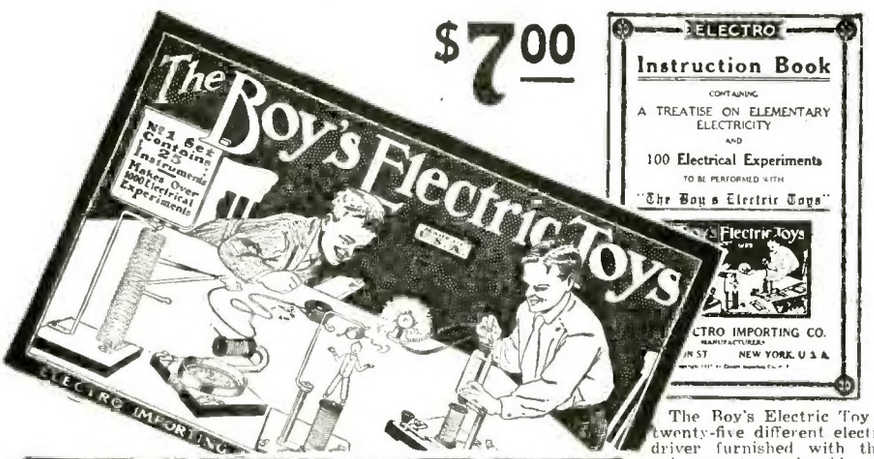
The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. 17 pieces of apparata furnished with this outfit.

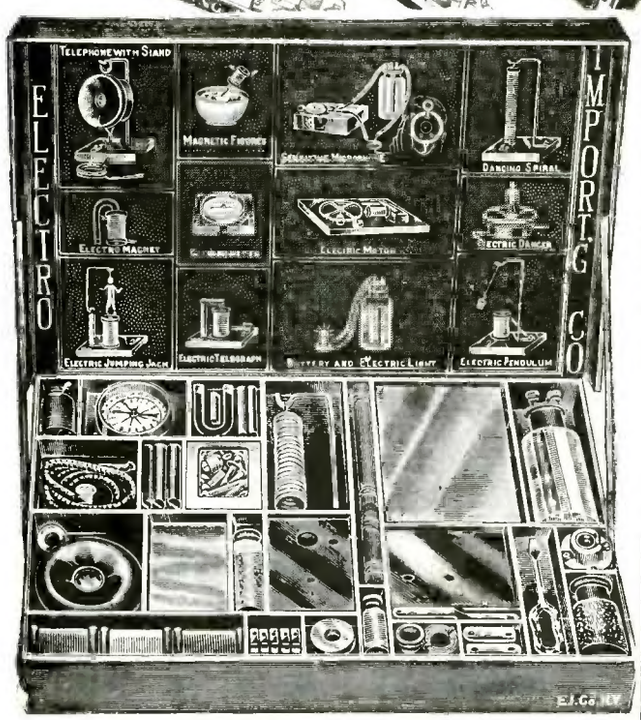
The instruction book is a real Chemistry Course for the Beginner. Some of the Contents are: Division of Matter: This is a Treatise on Elementary Chemistry, and deals with the theory of the Elements, Molecules and Atoms, etc.

100 EXPERIMENTS

How to make chemical tricks: how to make invisible and magic inks; how to test flour: how to test soil; how to make chlorine gas and smoke (German War Gas); how to bleach cloth and flowers; how to produce oxygen and hydrogen; how to make chemical colors; how to test acids and alkalies, and hundreds of interesting hints and formulas.

$7.00





Every Fellow Wants the

BOY'S ELECTRIC TOYS

The Boy's Electric Toy contains: Enough material to make and complete over twenty-five different electrical apparatus without any other tools except a screwdriver furnished with the outfit. Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp. Enough various parts, wire, etc., are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephones, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat erratic pendulum, electric butterfly, thermo electric motor, visual telegraph, etc., etc.,

This does not by any means exhaust the list, but a great many more apparatus can be built actually and effectually.

With the instruction book we furnish one hundred experiments that can be made with this outfit, nearly all of these being illustrated with superb illustrations. No other materials, goods or supplies are necessary to perform any of the one hundred experiments or to make any of the 25 apparatus. Everything can be constructed and accomplished by the means of this outfit, two hands and a screwdriver.

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We guarantee satisfaction.

The size over all the outfit is 14 x 9 x 2¾. Shipping weight, 8 pounds. "The Boy's Electric Toys" outfit as described, $7.00. Immediate shipment.

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233 Fulton St., New York.

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A practical system of constructive thinking that brings business and personal achievement.

"Why do so many men never amount to anything? Because they don't think."
—Edison.

MARK TWAIN once said that the average man didn't make much use of his head except for the purpose of keeping his necktie from slipping off.

And Prof. William James claimed that the average man uses only about a *tenth* part of his brain.

And Thomas Edison states emphatically that most men never amount to much because they don't *think*.

How about you? Are you using *your* head simply as a scarf-retainer? Are you using only 10% of *your* brain? Are you sitting, discouraged and discontented, at the foot of the ladder simply because you don't *think*?

It will pay you to find out.

Mind is the measure of every man. *Mental* power—not *physical* power—wins business battles and builds bank accounts.

The man with *brains* to sell fixes his own price, but the man who brings only *brawn* to market must be satisfied with the lowest wage that brute force brings.

In every age, in every clime and in every field of human endeavor the *trained thinker* wins where the *thoughtless toiler* fails.

Twain, James, Edison, Roosevelt, Rockefeller, Schwab, Carnegie, Woolworth, Wanamaker, Morgan, Hill, Harriman, Ford, Marconi, the Wright brothers and all other successful men reached their goals not because they knew how to use their *muscles* but because they knew how to use their *minds*. Does anybody doubt this? Isn't it admitted by all? Doesn't every one with "brains enough to grease a gimlet" *know* that it's true?

Only One Road to Success

Yes, indeed, there is only *one* road that leads to success and that is the *mental* road. If you expect to accomplish anything worth while by any other method than the *development* and *use* of your mental faculties, you are simply deceiving yourself. And the biggest fool in the world is the man who fools himself.

A recent magazine article states that intelligence tests in this country disclose the deplorable fact that 83% of the people are morons. You won't find the word "moron" in many dictionaries. It means a person with the mental development of a normal fourteen-year-old child.

Is it any wonder why so few people achieve any considerable success in life, when such an enormous percentage of them are so lacking in mental power? Such people have no more chance in competition with trained minds than a midget has to lick Jack Dempsey.

And isn't it simply absurd, when you stop to think about it, that most people are striving for success and yet they are doing absolutely nothing to strengthen and develop their *minds*, which is the *only* part of them with which they can ever hope to win success.

The principal reason that the trained *thinker* gets ahead is because he has so little competition.

The *unthinking* toiler works hard for small pay because almost anyone can do his work.

What are *you* doing—as the days go by—to develop *your* mind? Are you more efficient mentally than you were a month ago—or a year ago? If not, you are standing still. You haven't even started on the road that leads to *bigger* and *better* living.

Missing Success by a Hair's Breadth

The difference between *success* and *failure* is often but the breadth of a hair.

The man who is making *twice* as much as you are has nowhere near *twice* the intellectual ability. The man who enjoys an income of $10,000 a year is not *five* times the mental superior of the man who receives only $2,000.

Get this FREE BOOK

If You Are Interested in Learning

How to think like an arrow.
How to compel attention.
How to master important problems.
How to overcome fear and worry.
How to "tune up" your mental motor.
How to develop new methods.
How to originate new ideas.
How to learn quickly and easily.
How to attract valuable friends.
How to have more time for play.
How to out-think the average man.
How to make your mind a mental mazda.
How to stop thinking in circles.

Thousands upon thousands of earnest, aspiring men are *almost* successful. But in this connection a miss is as *bad* as a mile.

With just a little more *mental* force—with a slightly better trained *mind*—with a little clearer knowledge of *right* thinking—hundreds of men who are now struggling along in the Poor-Pay Army—footsore and weary—would immediately find themselves equipped to command from *two* to *ten* times their present incomes.

Probably the man who makes $1,000 a month is only 10% to 20% better trained mentally than the man who is trying to make both ends meet on $100 a month. This is a *fact*. And it should be a most *encouraging* fact to every man who wants to *be somebody* and *get somewhere*.

The greatest thinkers the world has ever known have hardly more than scratched the surface of their latent mental powers.

Improve your mental power only 10% and you will *multiply* your earning capacity.

Get This New Book

We have just published a new book—*The Secret of Mental Power*. We will gladly send you a copy upon request, with our compliments and good wishes. And we want to state—as forcefully as we know how—that you will find it one of the most interesting and mind-spurring books you ever read.

If you had to quit work for a month in order to get and read this book, it would probably be one of the most profitable months you ever spent. But you don't have to do that. It takes but an *instant* to sign the coupon. You get the book for *nothing*. And you can read it in *twenty minutes*, as it is a small book of 32 pages and 16 illustrations.

Send for a copy of this book today. It tells about the most practical, common-sense system of constructive thinking—the easiest and quickest method of mind-building ever discovered—the secret of developing mental power in a way that is as fascinating as a game.

This book shows you the difference between *disconnected, irrational, faulty* thinking and *coordinated, normal, true* thinking.

It shows how you can tell by a man's appearance whether he is a *true* thinker or a *faulty* thinker.

It shows how a *wrong* thought produces a *wrong* action that brings a *wrong* result. And how a *right* thought brings a *right* action that can bring only a *right* result.

It shows the immediate and favorable result of *virile, constructive* thinking and the disastrous results of *flabby, impotent, haphazard* thinking.

In other words it gives you the solution of correct thought process, which is the only secret of mental power.

Now Is the Time

Send for *The Secret of Mental Power* now. Do not delay. Do not put it off. Tomorrow you may forget all about it. And the loss will be yours, not ours. For although we have printed an edition of 20,000 copies, we do not expect to have a single one left at the end of thirty days. They are going—and going *fast*. Therefore act at once, for as Sophocles so truly said, "Heaven never helps the man who will not *act*."

Don't let the fact that you can get this book easily and at no cost deter you from sending for it or cause you to make the fatal mistake of undervaluing it.

There is, of course, no way of judging in advance how immensely valuable this little book may be to you. But by waking you up mentally—by showing you how to think straight—by showing you an interesting way to build mind power—it will convincingly prove to you that it is one of the most valuable messages that ever reached your mind, and that in taking advantage of this free offer you took a wise and positive step toward greater *mental* power, which is the *only* power that brings success.

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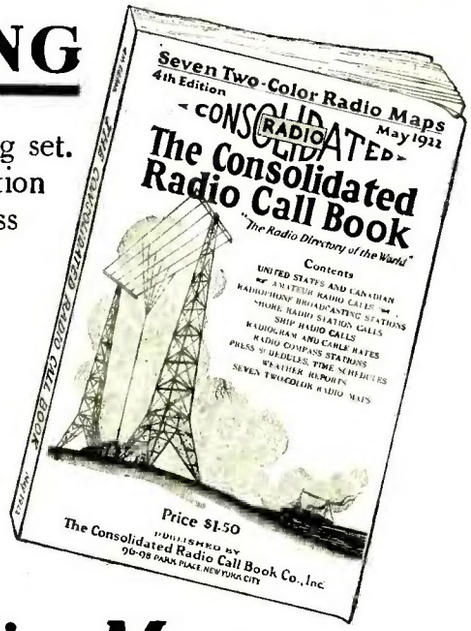
"Thinkers act while sluggards sleep."

KNOW WHO IS SENDING

Get twice the pleasure and usefulness out of your receiving set. Look up the name and location of any ship or land station whose messages you pick up—learn the name and address of that amateur whose sending set you just heard.



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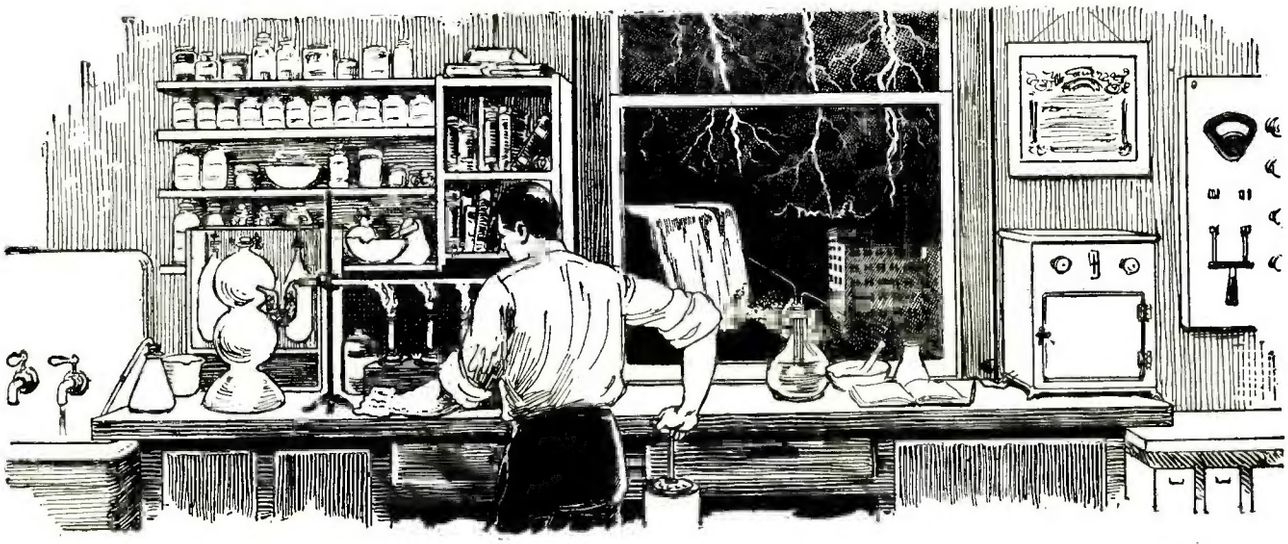
When the Chemist Harnessed the Thunder-bolt!



MAN and beast react with electric speed to a warning of danger, if the alarm is immediate and personal. Self-preservation is the first law of Nature. Yet subtle perils far more disastrous than any we expect to meet lurk in the shadow of our fancied security. They are the dreaded ogres of Famine and Disease.

A few years ago the world faced a famine more terrible than any in history. Nitrates, the most essential materials for enriching the soil, were being rapidly exhausted, and universal starvation seemed inevitable. Everyone knows that plants must feed, and if the ground is not replenished with the chemicals they have consumed, vegetation will eventually die out. Nature's way of making up the deficit is too slow for our concentrated population, and farmers have resorted to artificial fertilizers for ages. Europeans, always more receptive to the teachings of Chemistry than we, raise more than twice as much grain per acre as Americans, owing to their greater use of fertilizing chemicals.

The principal substance used for this purpose is sodium nitrate, better known as Chile saltpetre, because of the large deposits of it in that country. Millions of tons of this precious chemical were being mined annually, for vast quantities are consumed in making explosives and in other industries, besides that required for agriculture. Chile kept getting richer, but her nitrate beds got continually poorer until their inevitable exhaustion became a grisly prospect. *And there was no other source of supply!*

It was here that electro-chemists stepped in and devised a way of making nitrates from the air! They stole a trick from Nature, using an artificial bolt of lightning, the electric arc, to change the nitrogen and oxygen into nitric acid. This is indeed what happens during a thunder-storm, though to a very slight extent. Other methods followed, and thanks to Chemistry the air-made nitrates can now be sold for less than the saltpetre of Chile. Better still, the supply is unlimited.

Today we are confronted with similar crises. There are impending shortages of other important raw materials. Yet so great is the general confidence in chemistry to solve such problems, little anxiety is felt. A wealth of opportunity awaits the chemist of the present, particularly in the fascinating field of Electro-chemistry. In many industries there are hundreds of chemists employed by a single company. Thousands of concerns have chemists supervising the quality of their output and of the materials they buy. In countless capacities a knowledge of Chemistry is essential.

You Can Learn Chemistry at Home Dr. T. O'Conor Sloane Will Teach You

Dr. Sloane, Educational Director of the Chemical Institute of New York, is one of this country's foremost authorities on chemistry. He was formerly Treasurer of the American Chemical Society and is a practical chemist with many well-known achievements to his credit. Not only has Dr. Sloane taught chemistry for years, but he was for a long while engaged in commercial chemistry work.

The Chemical Institute of New York was originally founded to fill a long-felt need in the Educational field. Thousands of young men and young women, realizing the wonderful opportunities for the chemist produced by the recent war and the assumption by the United States of world leadership, were keenly anxious to enter this promising field. Many of these prospective students, however, were unable to give up their regular occupations to devote the necessary time to their training. Correspondence study at home was the only solution.

Dr. Sloane will teach you Chemistry in a practical and intensely interesting way. Our home study course written by Dr. Sloane himself is thorough, logical and remarkably fascinating. It is illustrated by so many experiments that are performed right from the start that anyone, no matter how little education he may have, can thoroughly understand every lesson. Dr. Sloane teaches you in your own home with the same individual and painstaking care with which he has already taught thousands in the class room.

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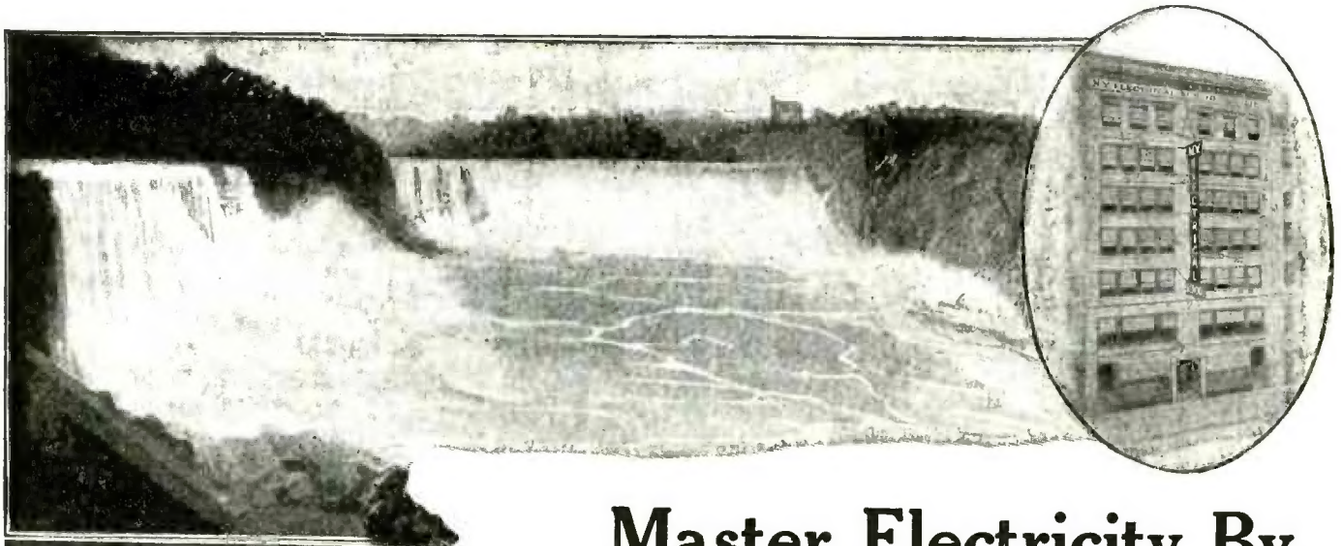

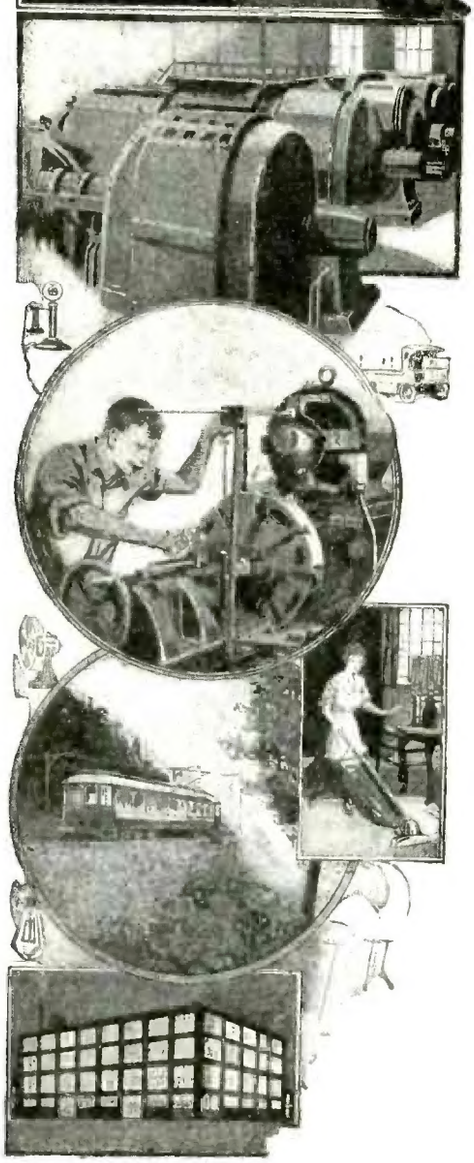

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Volume X
Whole No. 116

Science and Invention

DECEMBER
1922
No. 8

H. GERNSBACK, EDITOR AND PUBLISHER
H. WINFIELD SECOR, ASSOCIATE EDITOR
T. O'CONOR SLOANE, Ph.D., ASSOCIATE EDITOR
Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact"—HUXLEY

Into the Unknown

THE human being is provided with five senses, Sight, Hearing, Touch, Taste and Smell. All of these senses, as we well know, are far from perfect. One of the least efficient ones, perhaps, is the sense of smell, which may be said to be only about 10 per cent as good as that of any bloodhound. But even the bloodhound's sense of smell is far from perfect. There are many animals whose scent is very much better than a dog's. Our sight, too, is exceedingly poor, the human eye being one of the poorest optical instruments in existence. A few hundred years ago it was thought that man's eyesight was very keen. Then Galileo invented the telescope, and immediately a tremendous new world, the stellar universe, was thrown open to us, a thing we had never even suspected before. But even the telescope is now admitted to be a poor optical instrument, due to many defects which we have as yet not been able to overcome.

We are now upon the threshold of great and wonderful things. Just as the telescope has opened up entire new worlds to us, so will the Vacuum Tube, that wonderful little instrument, open up other worlds undreamed of, which even today lie unsuspected by our imperfect senses. By means of the instrumentality of the Vacuum Tube, it is possible today to weigh far less than *one-millionth of a gram*, a weight so small that it is almost inconceivable by man. This marvelous instrument will weigh the dust settling on the beam of a scale during a small interval of time. The time is coming when our eyesight will be amplified by means of the Vacuum Tube, when light impulses will be translated into electrical impulses, and back again into light.

While you are reading this, dozens of radio messages are passing right through your own body, although you are unconscious of them. The reason is, of course, that our senses do not perceive these radio waves, which does not prove that they are not there. The second you install a radio outfit, you know that you will be able to detect these waves, which are first translated into electrical vibrations and then finally into acoustic ones, so that our ears can perceive them. What other waves are floating about us it is difficult to conjecture. You may stand in a lonely desert, where to your senses there would seem to be no life, no sound: but just because our imperfect senses cannot register unknown impressions is no reason why we should say that the desert is dead. Outside of the radio waves that are floating about there may be hundreds of others which we have as yet not been able to register. There are heat waves which we cannot see, although we feel them. There are certain light waves, such as ultra-violet and ultra-red, coming to us from the sun, which our senses do not detect or interpret. There may be many other waves coming to us from the sun, of which we have no knowledge today. Every time the northern lights appear in the Aurora Borealis we know that this can be traced back to the sun. Some waves are coming from the sun that so far we have not been able to register.

We know that sound waves, heat waves, radio waves and light waves are all of the same order. The only difference is in the wave length. Thus the radio waves are rather long, while light waves are extremely short. Somewhere the light waves and the radio waves meet, one merging into the other, the same as one color of the rainbow merges into the other, but so far we have not been able to make radio waves short enough to know what will happen—for instance, when radio waves come down to 1 millimeter in length or less.

The human ear cannot hear below 8 vibrations per second and not higher than about 30,000 vibrations per second. Certain animals can hear below and others above that scale. By means of our Vacuum Tubes certain researches indicate that a tremendous amount of noise goes on below the 8 vibrations per second, and still more noise above the 30,000 vibrations. Entirely new worlds lie in these two directions, of which nothing whatsoever is known today. The Vacuum Tube is likely to solve these mysteries and take us into the uncharted worlds, far into the Unknown, within the next few years.

H. GERNSBACK.

Our Cover

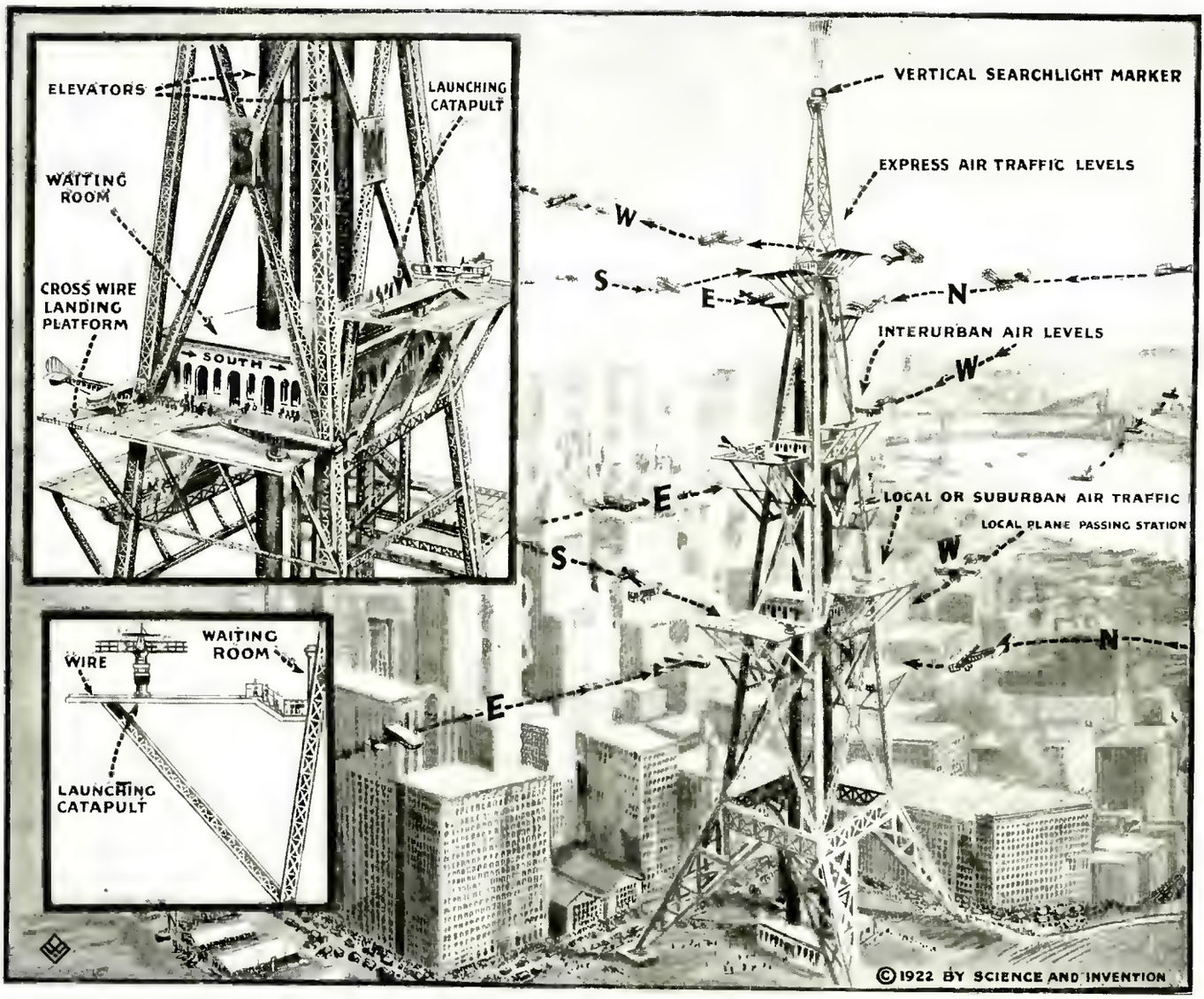
In connection with this month's cover design, nine departments have been chosen from our magazine, each one of these having been illustrated on our front cover.

This, as far as we are aware, is the first time that any magazine has employed such a feature.

The different departments, referring to the cover, are as follows:

NEWEST INVENTIONS.....Article on page 744
HOW TO MAKE IT.....Article on page 766
WRINKLES, RECIPES AND FORMULAS..Article on page 767
RADIO DEPARTMENT.....Article on page 768
POPULAR ASTRONOMY.....Article on page 758
SCIENTIFIC FICTION.....Article on page 750
LATEST PATENTS.....Article on page 778
CHEMISTRY DEPARTMENT.....Article on page 761
MOTOR HINTS.....Article on page 760

—EDITOR.



Air Traffic of the Future Will Without a Doubt Become as Important a Problem as the Present Automobile Traffic on Our Main Highways, and Mr. Gernsback in His Present Article Proposes a Novel and Artistic Plan Whereby Giant Steel Air Traffic Towers Will Be Used as Markers Both Day and Night, Besides Acting as Passenger Stations. Airplane Traffic, a Generation Hence, Will Logically Distribute Itself in Three or More Levels, as Here Shown; the Local or Slow Speed Planes Flying at the Lower Level; the Interurban Airplanes on the Middle Level, and at the Highest Level We Will Find the Express Air Traffic.

Future Air Traffic

By H. GERNSBACK

ANY one who goes riding these days in a motor car realizes that our main highways are becoming congested to such a degree that it will not be long before it will be almost impossible to ride at all, particularly in the environs of our large centers. If we picture what will happen ten years or twenty years hence, as automobiles keep on increasing as now, we may well wonder what the future of the automobile is to be. Of course, many people think that the solution lies in the air, and, indeed, this is probably the case.

With flying machines being developed as they are now, the time is not far off when our main road of travel will be through the air. Already air lanes are shaping themselves rapidly, and there are regular schedules in existence even now, more so in Europe than here. Regular air lanes are now in daily employment in Europe, and are coming into use in the United States as well. In ten years or less, we shall then be confronted with a situation in the air similar to that existing on the earth now; namely, an overcrowding of traffic.

If collisions on earth are often fatal, it would seem that any collision, ever so slight, in the air must perforce be fatal in nearly all instances. Two automobiles colliding do not produce fatalities at all times, but two airplanes colliding in the air certainly will, in nearly all cases, produce grave fatalities, for the reason that in an aerial collision the two airplanes will fall to the ground in nearly all cases.

So it would seem that in the years to come traffic regulations would have to be established in the air, just as they have been established on the earth, and without which regulations our big cities could not possibly exist today.

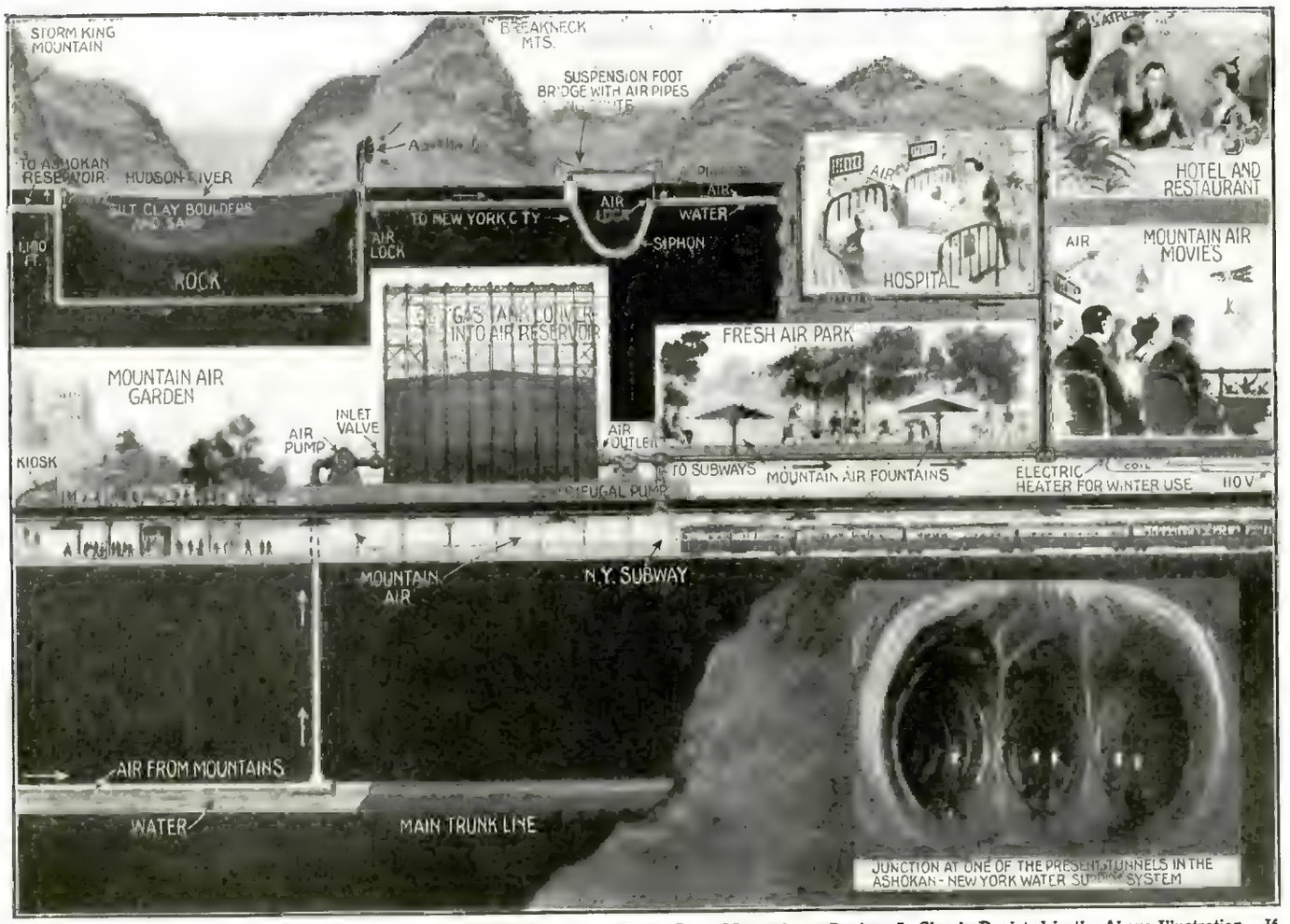
In the air the situation is vastly different for the reason that we have more than one level. On earth, given a street or road, the motor car traffic can be on only that particular street at one time. In the air we can have as many lanes of traffic as we choose, one above the other, for the reason that here we have two dimensions in which we can travel, whereas on the street we have only the one; namely, the surface.

So in the air we will probably have the Express Air Traffic levels, the Interurban Air Traffic Levels, and the Local, or Suburban Air Traffic levels. If any other levels need to be added there would be no objection to this. For instance, if we found that for the local traffic more than one level would be necessary, this could be arranged without difficulty. To elucidate: The Local level would comprise a zone of, say, from 200 feet to 600 feet above the ground. Between these two levels the Local Traffic would probably find sufficient room for all concerned. From 600 to 800 feet above the ground we would have the Interurban Air Traffic levels, while from 800 feet to 1,000 feet and upwards we would have the Express Air Traffic level.

The two latter levels could, of course, be elevated a great deal, once the airplanes left the cities. Thus, for instance, the Express Airlines will probably travel at a height above 5,000 feet, while the Interurban planes will travel at a height of probably 2,000 feet or thereabouts.

The speed as well as the levels on which airplanes can fly over cities will probably be severely regulated just as for motor cars

(*Continued on page* 804)



The Possibility of Supplying Large Cities With a New Invigorating Atmosphere Piped From Mountainous Regions Is Clearly Depicted in the Above Illustration. If the Methods of Procedure Above Outlined Are Still Further Elaborated Upon Cities Will Be Supplied With Mountain Air at Practically No Cost; the Present Pipes Used for Supplying the Large Population With Water, Sufficing to Conduct the Air Wherever Desired. The Installation Would Prove a Source of Constant Revenue, Inasmuch as Hotels and Theaters Using This Air Would Pay for It at a Certain Rate Per Thousand Cubic Feet.

Mountain Air Piped to City

By JOSEPH H. KRAUS

"GO to the city to enjoy mountain air!" is going to be the password in a few years, when country folk will be flocking to New York and other large cities in order to get the benefit of the exhilarating atmosphere so plentiful in mountainous resorts.

Does this idea seem absurd? Not at all. At the present time New York City is getting its water supply from just such a source and the water is, without a doubt, much better than in years past. The water to supply New York is piped for a distance of 114 miles, from the Catskill Mountains to various reservoirs, finally reaching the city, but this long conduit can be put to another use, namely that of supplying the healthful mountainous atmosphere to the populace of the sweltering city.

In the summertime the heat in New York is oppressive. Here immense buildings with their private generating plants are constantly throwing quantities of heated air over the city and factories assist in forming a human smelting pot. Some streets are narrow, flanked by tall buildings on both sides, offering a heat reflecting and concentrating surface of no small proportions. The terra-cotta and stone work become warmed by the sun's rays and seem to add to the already existent heat by beating down upon the sidewalks and making the streets doubly unbearable. Any slight breeze which may be set up around the Hudson River is, by the time it reaches the city proper, so sidetracked and disturbed that those in the interior of the city would not know of a wind storm existing but a mile away. Consequently this piped air would be of particular value, and, inasmuch as it can be sent down to free the suffering people of their rather torrid mantle, without any additional expense, it is quite evident that our engineers will work up the plan in greater detail.

In the reservoir's supply pipe which leads from the source in the mountains, several gigantic aspirators are inserted. Due to the force of the water, a great quantity of air is sucked in and carried with the water to the greater city. Of course, there are reservoirs interposed in the direct plan, but these reservoirs will not hinder the supply of air, for pockets can be arranged which will catch the air and permit it to pass through a coupling pipe to the continuation of the water ducts which travel to the next relay station. Finally a voluminous amount of cool, healthful, mountainous air reaches the city. It has undergone no change whatever, and up to the present stage is absolutely costless.

In the city a series of blowers will distribute the air to various subways, and by means of the present sub-tubes, this air would be transmitted through the entire system. We will admit that a great quantity of it would flow out through the present subway kiosks nearest the air entrances and a lesser quantity through kiosks along the route, but tests at further stations will determine just where an additional supply pipe should be inserted. Thus a second branch supply will be found at 125th Street, then at 96th Street, 42nd Street, 14th Street, and Brooklyn Bridge, additional supply pipes will open into the stations. The trains passing through the subway will help in forcing this air through the entire system and passengers will no longer find the heat in this subterranean railway so oppressive.

In addition to that, theaters would come in for a mountain air supply. Each without a doubt will have its individual piping system connected to the main line, just the same as the steam is now supplied to many of the smaller show houses. The theaters would advertise that the temperature of their play houses is fully 20 degrees below the temperature in the streets, and that mountain air was being administered to their patrons in daily doses. We would find it just as difficult, then, to get a seat in a theater as it is upon a nice, cool evening, because, instead of rushing to the seaside resorts, city folks would rush to the play houses to get away from the abominable temperature.

Then the city will take another step toward making the island more inhabitable. Around each subway kiosk a small parkway with a few trees and several chairs, as well as a drinking fountain will be found. These resting places will, without a doubt, be daily occupied by children and their parents. Here the stream of healthful air will always be available as it pours up through the stairway from the subway below. Automatically

(*Continued on page* 807)

Above is Shown the General Lay-out of the Operating Room, the Electric Chair and Switchboard, in the New York Play "The Monster". Our Fair Heroine Who Is to Become the Subject of a Vivisection Operation Is Strapped to the Operating Table. At the Right Is a Close-up View of the Electric Chair. This Is a Good Example of a Stage Replica of the Famous Chair at Ossining, Except That in the Play the Cap Is Not Placed Upon the Head.

The Monster

IN three acts this remarkable play, now appearing at the 39th St. Theater, New York City, gives us a succession of squeamish thrills and cold shivers in the region of the spine. Some of the happenings which occur are not only mystifying to an unusual degree, but are responsible for the shivers of which we spoke.

The prologue suffices to tell us that for some unknown reason, automobiles have been in the habit of falling into a gulch, the occupants of the cars never being recovered. A newspaper reporter suspects that the disappearances are due directly to the owner of a large mansion, who, it is thought, is an eccentric.

A girl is brought into this house one stormy night by the newspaper reporter. She had just met with such an accident, and she explains that she thought someone had lifted her car bodily, and was attempting to drag her from beneath the wreck, when the reporter appeared upon the scene. They are in the house when they discover that "Red" Monahan, who appears to be a sneak thief, is also on the premises. "Red" had already discovered that the house was seemingly haunted. Doors creaked, the clock struck thirteen, bloodcurdling wails were heard, the walls resounded every few moments, hideous faces insisted upon appearing at cupboard doors, candles were blown out, and other spooky manifestations were in constant evidence.

Dr. Ziska, the engineer of this establishment, finally appears upon the scene, and offers the hospitality of his home to the intruders. While in the bedroom, they discover a sack, which probably housed a corpse. Starting the fire, they are finally overcome by the narcotic soaked wood, the girl falling to sleep upon a bed. The canopy of this is seen to gradually descend, and would have smothered her right then and there, were it not for the prompt assistance of Monahan and the reporter. The reporter, while fanning the flames, is completely overcome, and placed upon a couch by Monahan. On another couch, upon which the girl is reclining, a pair of arms seem to rise from the base, which clasp her, pinning her to the couch, and she disappears from view. The reporter likewise vanishes. The final scene shows Dr. Ziska in an operating room, depicted in our photograph. The girl is strapped to the operating table, while the reporter is seen in the electric chair. There is going to be a vivisection. The girl will remain completely conscious while the doctor operates on her. The Monster thus, will square an old grudge against the girl's father, who had wronged Dr. Ziska while he was practicing in France. The reporter has received several electric shocks as a tonic, but is not by any means unconscious. The audience is very glad, when finally the tables are turned, and the Monster suffers electrocution, the fate intended for the reporter under the offices of his tongueless negro servant, acting in misplaced zeal, "Red" Monahan announcing finally that he was an insurance company detective.

With its creaking doors, spooky settings, and its final dramatic climax, this is one of the season's masterpieces among mystery plays.

An Engineering Mystery

THERE has been developed a very ingenious process of making hollow drill steel bars. The center is perforated by a small hole which extends from end to end of the bar, and in consequence of the demand for such drill steel there has been developed a way of making the hole without drilling. The billet of steel from which the bar is rolled is drilled in the first case, and the hole is packed tight with a special composition clay or the like. The ends of the hole are subsequently closed by plugging and welding. When the piece of metal is rolled in the mill into a long bar, the packing stretches with the metal and preserves the continuity of the hole and is removed from the finished bar. One of the most important applications of this hollow bar is for mining drills where the hole is used for a jet of water to cool the cutting edge and prevent dust. Where water is used it converts the dust made by the tool into slush before it can rise and be breathed by the miner. Thanks to this process it is probable that the liability of miners to tuberculosis will be greatly minimized. Hollow steel bars are also being used for a great variety of purposes in motor-car construction and elsewhere.—F. H. SWEET.

Ball-Bearings for Railway Cars

A RAILROAD car so easily moved that its brakes must be kept on lest the wind start it off, is to be tried out on the English Great Eastern Railway. It has its wheels fitted with a new ball-bearing device, and it is to have tests for some months on a branch line where it will not be very serious if it breaks down.

Railroad engineers have no doubt of the saving in power it will effect if it passes its trials, but they are not certain that it can stand the wear and tear of actual use. Its inventors claim, however, that it is constructed of steel specially hardened by a method discovered in the war.

"Dummy Observer" for Airplanes

By ERNEST JONES

A SIMPLE method of photographing continuously on a strip of film the air pressures, plus or minus, simultaneously at any number of points on the upper and lower surfaces of the wings of an airplane in flight is one of the recent accomplishments of the Army Air Service at its experimental plant at McCook Field, Dayton, O.

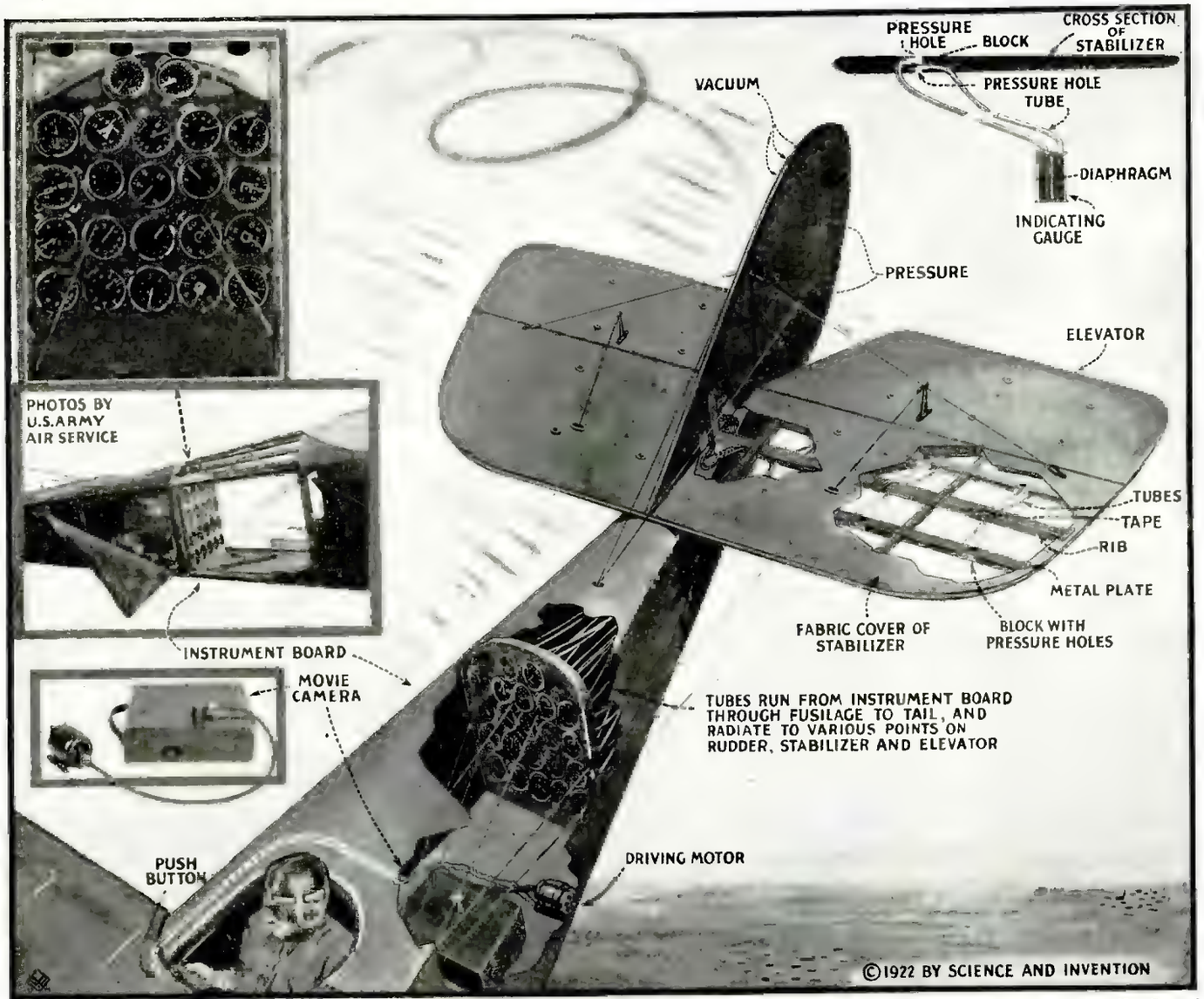
The measurement of these pressures is not unusual, but it is obviously difficult for a human observer to simultaneously record the readings of a number of instruments. The motion picture camera now photographs at set intervals of time an entire battery of registering instruments.

A standard camera, used ordinarily in the motion picture industry for photographing titles, was direct-driven with a small electric motor through a flexible shaft. This camera lay flat opposite an instrument board placed in the fusilage of the airplane, but with the gear box down to facilitate focusing through a sight glass. The motor was situated conveniently and operated off a storage battery by means of a switch in the pilot's cockpit and at the will of the pilot. The measurements could, therefore, be photographed either in normal horizontal flight, or in the course of turns, loops or spins or any other acrobatic manœuvre.

The pressure distribution over the horizontal surfaces of the tail—rudder, elevators and stabilizers—was obtained by connecting the air pressure instruments shown in the enlargement of the film record, by tubing to the surface to be investigated. The instruments were calibrated in lbs. per square foot. The opposite sides of the diaphragm in these instruments were connected to the top and bottom respectively (or *vice versâ*, if necessary) of the surface to be measured. In other words, a surface which showed pressure on the bottom and suction on the top would have the resulting action integrated in the instruments, and during flight the exposed films showed the instrument reading, or the pressure at a particular point during any manœuvre which the pilot chose to investigate.

The outer ends of the tube which were flush with the surface were distributed and arranged over the stabilizer and elevator in such locations and distances as to obtain as complete information as possible. In addition to this, speed meters as shown, together with a dial to indicate the elevator setting, were installed to give more complete information regarding the manœuvre.

The arrangement of the rubber air tubes here provided is very clever, but it would seem that some improvement on this scheme might be worked out, utilizing electric wires instead, which would not be subject to damage as easily as the rubber tubes. Microphones of special construction could be used as the pressure and vacuum detectors in the holes on the wing and tail surfaces, changes in pressure against the diaphragms of the microphones causing electrical resistance of the carbon grains within them to change, and this resistance variation in turn being indicated on the galvanometers placed on the dial panel in place of the present gauges. It is peculiar in a way, that this rather simple idea was not thought of and employed a long time ago, as one of the hardest problems to solve in designing an airplane is to know beforehand just what pressures to design the various parts to withstand.



The Clever Arrangement of Pressure and Vacuum Meter Dials Here Shown, Installed on One of the U. S. Army Airplanes at McCook Field, Dayton, Ohio, Has Served to Place Valuable Data in the Hands of Flying Experts and Airplane Designers, Which It Has Never Been Possible to Accumulate Heretofore. It Would Be Humanly Impossible to Read All of These Meter Dials at Any Given Instant, and Not Only This But in Making Quick Turns and Studying the Resultant Pressures and Vacuum Effects on Opposite Sides of Tail and Wing Surfaces, an Observer Could Not Be Expected to Catch the Various Changes in Readings Occupying a Small Fraction of a Second. This Problem Was Finally Solved in the Manner Illustrated, viz., by Resorting to a Moving Picture Camera Driven by an Electric Motor, so That Whenever the Pilot Desires to Make a Record of the Meter Readings, He Has But to Push a Button in the Side of the Cockpit, Which Starts the Electric Motor Driving the Movie Camera. This Camera Lies in the Bottom of the Fusilage and One of the Movie Snapshots of the Meter Board is Shown in the Upper Left Hand Corner.

The Center Photograph Shows Miss Beulah L. Henry and a Few of Her Inventions. In the Upper Left-Hand Corner Is a Pocketbook, the Covers of Which Are Removable. Beneath the Flaps Are Mirror, Powder Box, Tube of Rouge, Pin Container, Writing Paper, Stamps and Pencil. To the Right of This Is a Pencil Cap, Which Contains a Long Eraser, Fed Out as Used. Upper Right Photo Shows Miss Henry With a Vacuum Container for Making Ice Cream, Which May Also Be Used to Keep Liquids Hot. Lower Left Photo Shows a Doll With Changeable Eyes, Hair and Dress. Lower Right Photo and Drawing Illustrate an Umbrella With Changeable Covers Held in Place by Snap Fasteners.

An Interview With the Lady Edison

WITH more than thirty-three inventions to her credit, and still working upon other ideas, among which we would include a collapsible umbrella, Miss Beulah Louise Henry would be classed among the leading inventresses of the world in any court. During an interview she showed a few of her many inventions, all of which she had patented. Of course, there are many other ideas which are not yet covered by patents, and upon which Miss Henry is at present working, but all of her really worthwhile devices are or are being well covered by patents in not only this but in foreign countries as well.

She now produced an umbrella almost as a magician would, and fingering it lightly, she unrolled and slowly opened it, saying, "Now, to the best of your knowledge this seems like an ordinary umbrella, doesn't it; opens and closes just like one, made of a very good quality of silk, and has as you will notice, a very pretty handle and a tip to match, but the silk is of a navy blue shade? Now if you had an orange colored gown on, an umbrella like this would hardly be appropriate, so naturally you purchase another umbrella to match your dress, but umbrellas of this quality are rather costly, and in the end you would have purchased a whole rackful of umbrellas or parasols to suit your particular requirements. Not so here however."

With a few rapid movements she unsnapped the edge of the silk from the ribs and pulled off the covering, leaving the bare ribs exposed, the entire operation occurring practically in the twinkling of an eye. Almost as quickly, an orange cover was mounted upon the rod and snapped in place. While doing this Miss Henry continued,

"You see you need not fear ripping an umbrella of this nature because it will not take a long time to search for a repairman, nor will it be extremely expensive to completely recover the frame. It can be done in but a few seconds, and the umbrella is as good, if not better than new. As time progresses we shall make these in different shapes and styles, all standardized, so that one cover is interchangeable with another, regardless of where it is purchased, and notice how neatly it rolls up."

She suited her action to her words, and simply placing her left hand around the silk, she rotated the handle, the umbrella rolling up neatly. There are no frayed edges when it is so rolled up, nor are there any peaks, the top being seemingly scalloped and neatly rounded off.

"And I even play with dolls," Miss Henry continued, as she set aside the umbrella. She showed me a doll. Seating this in her lap, she removed the doll's dresses and showed its body. This is made of flesh color rubberized silk, stuffed with cotton. It has a warm feel when touched, and would remind any youngster of the soft pliable body of an infant, the color and touch being the nearest approach to the human skin which the writer has ever seen. The doll can be immersed in a tub and washed without injury. It had brown eyes, brown hair, a red bonnet trimmed with cream colored lace, and a red dress trimmed to match the bonnet (or else the bonnet was trimmed to match the dress, it does not make much difference). Opening the bow under the doll's chin, she removed her bonnet and her dress.

Putting her fingers on the hair near the temples, a slight snap was heard, and the wig came off. A little lever could then be seen on the back of the doll's head, which when worked in and out rotated the eyes on a ratchet principle, and changed them from brown to blue. A blond wig was now substituted for the brown, and the dress and bonnet turned inside out, and replaced upon the body. The result was a blond-haired blue-eyed miss, displaying a blue hat and gown trimmed with white. This doll is called *Miss Illusion*.

Aside from that Miss Henry has invented a pocketbook on which the covers may be changed, as illustrated in one of our photos. Here a leather covering can be substituted for one constructed entirely of beads or velvet. It snaps in place upon the frame which is well designed, and so arranged that it can open but to a limited extent. Nevertheless, the opening is large enough to admit access to its interior, which is very spacious. A flap in the cover reveals on one side two pin receivers, a powder-puff and a mirror, and on the other a gold pencil, a fountain pen, a compartment for stamps and pad of writing paper and envelopes. One would naturally think that the pocketbook was very bulky to house all these objects between the frame and the outside cover, but such is not the case. In fact it is so well designed that one is astonished at the mass of material found therein. One can readily see by the insert that the entire covering has been partially removed to show these objects.

A very large ice cream freezer, which will keep ice cream for seventy-two hours, is another of her inventions. Not only can this container be used to make ice cream, but it can be employed for keeping liquids piping hot. It consists of a metal can fitted with gauges, the sides having a space between the outer and inner walls from which air is exhausted by means of a pump. Note the spigot arrangement for delivery of the hot liquids and also the whipper for the freezer, which Miss Henry is holding.

Then there is an eraser which can be fitted to any pencil, and which contains a long circular eraser about 1½ inches in length, so that by merely twisting the pencil, the worn eraser can be renewed. A clip is fitted to this cap to secure the pencil in the pocket. Our sketch shows the device In addition to that, there is a tiny little device which is called a runner shield for umbrellas. At the present day these runner shields are sewed in place by hand, the cost of the same being about 3½c a piece. The shields which Miss Henry has invented is merely slipped in place. Being made of spring brass, it will not tarnish and may be removed or replaced very quickly. It reduces the cost of these runner shields more than three hundred per cent.

Air Speed Records Smashed

The month of October, 1922, will go down in aeronautical history as one in which many speed and endurance records were broken. Up to this time the official world's speed record was that established on September 26, 1921, by Sadi Lecointe, who traveled 205.2 miles per hour at Paris, France.

Great interest has been aroused in America by the Pulitzer Trophy race held in Detroit, Mich., and it was in the trials for this race, and the race itself, that many new records were set. On October 8, Lieut. R. L. Maughan, while practicing at Garden City, L. I., for the Pulitzer Trophy race, piloted his plane over a straightaway measured course at the rate of 220.45 miles per hour.

During this flight, the aviator, flying at a speed greater than that ever before attained by a human being, made a right angle turn; a feat which, up to the present time, has been considered impossible. Lieutenant Maughan said that when the plane turned, he became unconscious, stunned by the centrifugal force. However, he recovered his senses in a few seconds, regaining control of the machine.

On October 14, Maughan won the Pulitzer Trophy by flying at an average speed of 206 miles per hour over a 160-mile course. On this same day, Lieutenant Maughan and Lieutenant Maitland took the air as the eighth and ninth starters, and performed a feat which, officials say, has never been equaled. Both planes shot from the starting line, and leaped almost vertically upward on the encircling journey around the field before the planes crossed by the judges' box. This is a performance that has never been accomplished before, and Curtiss officials believe that they will eventually have vertically rising planes.

On October 16, the winner of the Pulitzer Trophy, covered a 1 kilometer course at a speed of 248.5 miles per hour. This record was electrically timed by officers from the McCook Aviation Field. The speed however, is not officially a world's record, as no representative of the Federation Aeronautique Internationale was present. This speed was made in the same plane with which he won the trophy—a Curtiss biplane, powered with a 400 horse-power Curtiss engine.

On the same day Lieutenant Maughan astounded officials by flying a distance of 1 mile with the machine on its side. In reality, he flew without the aid of wings.

On October 19, Brigadier General William Mitchell set a new official world's speed record of 224.05 miles an hour. The test was timed by officials of the Federation Aeronautique Internationale, thereby making the record official. The plane used was the one in which Lieutenant Maughan attained a speed of 248.5 miles an hour.

The previous record for sustained flight was made by Stinson and Berthaud last December at New York, when they stayed in the air 26 hours, 19 minutes and 35 seconds. However, on October 6, 1922, Lieutenants Macready and Kelley remained aloft in a monoplane, T-2, at San Diego, Cal., for a period of 35 hours, 18 minutes and 30 seconds. The only reason that they came down at the end of this time, was because dusk of the second day was drawing near, and they were afraid that if they stayed aloft after dark their gas and oil would run out before morning, whereupon an accident might occur in landing in the dark.

On October 15, at Paris, two French airmen, Bossoutrot and Drouhin, attempted an endurance record, but ran out of fuel after staying aloft for 34 hours, 14 minutes and 7 seconds, during which time they covered a distance of 4,452 kilometers, or approximately the distance from Paris to New York. The machine used was a Farman Goliath, which consumed 4,200 liters of gasoline for the flight. This last record is considered as official by the French Aerial Federation, as the record made in America was not made under conditions accepted by the Federation, of which the United States is a member.

Transmitting Niagara Power By Radio

NIKOLA TESLA has consistently argued that it is only a matter of time when radio and electrical engineers will advance from the present stage of radio transmission, whereby telegraphic or speech waves are propagated and received only, to that dream of all electrical men—the transmission of electric power without wires. Recently a sixteen hour continuous test was carried out in transmitting wireless telegraph signals across the Atlantic Ocean, with the aid of nine high power metal vacuum tubes of giant size, or about three feet in length, six of the tubes being rated at twenty kilowatts each and taking the place of the large Alexanderson alternator previously employed. The development of these huge audions or vacuum tubes to a still greater degree has aroused the scientific imagination of great engineers like Dr. E. F. W. Alexanderson, of the Radio Corporation of American and others, to predict that such tubes may indeed lead the way eventually to the fulfillment of Tesla's life work—the wireless transmission of energy. Dr. Alexanderson at the time of the successful experiment with the new high power vacuum tubes in radio telegraphing across the Atlantic spoke in regard to the transmission of power from Niagara to New York through the air by means of such powerful vacuum tubes, saying:

"We have seen here a new physical principle reduced to practice on a large scale. Shall it make real the dreams, that Edison's dynamo has not yet fulfilled, and carry Niagara's power to New York? Atlantic radio telegraphy has become a routine business, but the importance of this demonstration is the bridging of the ocean by a few powerful vacuum tube units; in this case only six tubes were used, and we can safely predict that the same feat will some day be performed by a single tube. But what is the next?"

After speculating on the possibility of radio power transmission, which it is known he regards as something more than a mere dream, he said:

"Ten years ago I became acquainted with the little device known as the audion. Then it was a detector of signals and an amplifier, and the question arose: Why not amplify some more and then some more and use it for transmitting signals as well as for receiving?"

Dr. Irving Langmuir, who is responsible for the development of the wonderful new high power vacuum tubes, said:

"Although it has taken ten years to get to the point where we have today a transatlantic tube transmitter, in these ten years the energy of the vacuum tube has been increased more than 1,000,000 times. A few more years of the same rate of improvement would bring us beyond our wildest dreams, but all we need to say is that science and engineering have received a new tool. It marks a turning point, like that determined by the steam engine and the dynamo. It will certainly give us transatlantic telephony, but it will undoubtedly give us more. I am greatly pleased but not surprised at the success of the tubes. It is a stepping-stone in the progress of many years' development. We will make larger tubes when larger tubes are needed, and we will make them of higher efficiency: for the principle on which this development has gone forward is a sound one."

The human voice has already been carried across the Atlantic by radiophone, but only in one direction. By means of these new electron tubes, it is expected that the voice may be sent readily both ways without difficulty, and regular conversation carried on at any time of the day or night. The set used at present for transmitting radio telegraph signals across the Atlantic from England to Germany, from the Radio Corporation station at Rocky Point, L. I., consists of three 50 kilowatt, 15,000 volt, water-cooled metal-vacuum tubes of the Kenetron type, which are used as rectifiers; there are six 15,000 volt 20 kilowatt tubes of the water-cooled metallic type and designed as pliotrons, for use as high frequency converters. For the experiment with the tube set one of the new mile and a half long antenna was used, suspended from six towers, 420 feet high, and the tube set succeeded in developing and sustaining in the antenna a current of 350 amperes. About 600 amperes have been used with the Alexanderson alternators, but it has been found that with the development of wireless apparatus, a lower amperage may be used.

January Features in Science and Invention

Modern Bath de Luxe. By H. Gernsback.

Practical Photo Hints. By Dr. Ernest Bade.

The Geometry of the Eye.

From Ocean Depths to Mountain Heights. By Charles Nevers Holmes.

Grain Pipe Line 1,400 Miles Long. By Ray Dyment.

Advertising Signs on Water's Surface.

X-Rays and Electric Current to Kill Cotton Weevil.

Operation of a Naval Radio Station. By A. P. Peck—With Exclusive Photos.

New Scientific Scheme for Lighting Niagara Falls.

New Airplane-Dirigible Can't Fall.

What Happens When You Burn Yourself. By Joseph H. Kraus.

The radio power transmission scheme of tomorrow, whereby the thousands of horsepower inherent in the power of Niagara can be transmitted for hundreds and even thousands of miles, will no doubt be along the lines shown in the accompanying illustration. Here, as will be seen, the water from above the Falls is led through pipes or closed channels to water turbines. These turbines are directly connected to alternating current dynamos and the electric power from these dynamos is in turn led to step-up transformers. These transformers raise the potential to several million volts and the current at this high voltage then passes through rectifier and converter vacuum tubes of the water-cooled type, as shown in the illustration, the radio frequency power waves being radiated from directive antennas placed on top of high towers, as the picture shows.

A directed radio power wave is possible with the present knowledge of the science, following the experiments of Marconi, which were explained and illustrated in the August issue of SCIENCE AND INVENTION. The principle of directing a radio wave on this hypothesis is to place a shield in either the form of a metal cage or sheet around the antenna wire with a slot or opening on one side, out of which the wave is directed.

The reception and utilization of a radio power wave is accomplished as follows: An antenna or capacity of some sort, is employed to accumulate the desired quantity of radio frequency energy from the ether and ground, and by means of vacuum tubes, step-down transformers and other apparatus well known to radio engineers, this high frequency alternating current energy is reduced to a low frequency alternating current, or even to direct current at any potential desired. The radio transmission of power always sounds like a wild dream to the average person, because it seems impossible of accomplishment, but when one stops to consider that Dr. Tesla lighted lamps at a distance of one-half to one mile from his transmitting instrument in his famous Colorado experiments over twenty years ago, and also that latter-day experimenters have often picked up a considerable amount of energy in antennae located at some distance from high power radio transmitting stations, it dawns on us that all we have to do to transmit electric power via radio, is to increase the frequency of the waves, and solve several other factors, yet to be determined by the electrical and radio experts of tomorrow, and man will then laugh at the present expensive conductors required to transmit the current which lights our lamps and runs our motors.

The directive radio antennae atop the tower shown in the picture, are operated by motors and gears, so as to be turned in any direction. The three small directive power wave transmitters at the extreme top of the tower, can be swung in any direction desired. When we come to transmit electric power via radio, aircraft of every sort will absorb the necessary energy directly from the air or rather the ether.

No doubt strict laws would have to be passed establishing severe penalties for anyone erecting an antenna or attempting to use for industrial or other purposes, the radio transmitted energy without a license and proper meter. Otherwise people would be apt to steal energy surreptitiously, by concealing the antenna under roofs, in the walls of buildings, etc.

But the Langmuir high power vacuum tubes by themselves, we are sure, will not solve the problem of radio power transmission. Thus there is a vast amount of work yet to be done by our radio and electrical engineers and students everywhere, before this great dream of Dr. Tesla's becomes an accomplished everyday fact. Greater efficiency of transmission through the ether has got to be made possible, and this may eventually be brought about by increasing the frequency to at present undreamt of values, and also by increasing the potential or voltage to much higher values than any heretofore employed. Dr. Tesla, of all scientists, has conducted the greatest experiments with high potentials and high frequencies that the world has ever seen, and it is certainly remarkable that in the intervening space of more than twenty years, engineers have not learned more along the lines of his famous experiments, especially those carried out in his Colorado plant, where he produced man-made lightning flashes approximately 100 feet in length, accompanied by a roar like Niagara's, which could be heard for many miles.

The Warship of 1950

By GRASER SCHORNSTHEIMER

NAVAL EXPERT

IN THE next twenty-five years the world will witness some remarkable changes in the methods of naval warfare. And because of the geographical position of the United States—two land frontiers facing two nations utterly incapable of making war upon us and three great sea frontiers, facing every powerful nation in the world—these changes affect us greatly.

During the Great War there were two great forces of destruction brought out—the big gun shell and the torpedo. But since the war two entirely new weapons have been developed to a very important and dangerous degree—gas and aircraft bombs. Therefore, unless America changes her defensive types to meet these new weapons, our country will face destruction at every throw of the diplomatic dice.

Secondary only to the offensive characteristics will be the defensive features of the new ships. They will be literally loaded down with armor and other protective material. The main armor will be against the heavy shell fire of both extreme and short range varieties. The hulls will be heavily blistered and internally cushioned against torpedoes and mines. The top decks of the ships will be coated with armor strong enough to resist the most powerful bombs which can be developed. But the most important thing will be the ventilating systems.

A warship breathes through its ventilators and through those ventilators may come the most poisonous of gases. But in the future ships must be air-tight in so far as this is possible. The ventilating systems must be enlarged and instead of one or two sets of ventilating systems there must be dozens. The ventilators must all be gas-masked.

We here have the mandate characteristics of the new vessels. Now let us see how large a vessel it is going to be. The order to the Chief Naval Constructor does not read, "build a ship of so many thousand tons," but, "design a hull which will carry so much armor, so much armament, so much machinery, so much fuel and supplies, so much equipment and be habitable by so many men." The Ordnance experts have studied the designs of existing warships and determined the weight of guns to be carried by the new ship and how much armor the same ships must carry to be safe from the guns of existing warships. The gas defense division works out the ships' ventilation and various other bureaus and divisions work out the other features.

It has been decided that the ship must throw a broadside of 42,000 pounds of explosive shell and that the guns must have a range exceeding the maximum scope of visibility. To this end a battery of twelve 18-inch, 50 caliber guns are specified. They are to be mounted in four turrets with three guns to each turret. The ship is to be saturated with armor and weight must be saved at every possible spot. The turrets are carefully designed. The tops receive a moderate amount of armor as they will have to resist both big gun shells and bombs from aircraft. The sides and rear of the turrets are not armored heavily, just enough to resist the small shell of cruisers and destroyers. But the fronts of the turrets, from which the guns look out at the enemy, and which are, therefore, always facing the enemy, are very heavily armored. In the future, as much as 20 inches of the toughest armor may be used for turret facings. These turrets are mounted on barbettes which extend to the bowels of the ship and through them run the ammunition hoists which connect the guns with the magazines.

These big guns fight the battles against big ships. But a warship must be able to defend itself not against big ships alone, but against destroyers which rush through the water at 40 miles an hour to send

This article by Mr. Schornstheimer, well-known American naval writer, has been written by special request of the editors, and we believe our readers will enjoy it, as he gives us some practical ideas as to what the great fighting ship of some twenty-five years hence will look like. One of the greatest problems, if not the greatest of all, which the warship of tomorrow will have to contend with, is the proper defense against enemy aircraft. Not only will aircraft in the very next naval battle try to bomb and sink warships, but they will also try to incapacitate the crew by dropping gas bombs, and so as we see in the accompanying illustration, special precautions will have to be taken to properly protect the ventilating system of our future warships. At present individual gas masks are supplied the crew.

home their torpedoes. For this reason a secondary battery of 6-inch guns is mounted on the ships. They are given very high positions whenever possible. In the ships of the future, these secondary battery weapons will be enclosed in small turrets with several guns to a turret, that the ventilating problems may be worked out to a better efficiency. These guns will not only be efficient against destroyers operating at a high speed but also against submarines which slowly sneak in close to a ship to deliver their blows. Then, too, those guns of the secondary battery which have the clearest outlook to the sky will be mounted on high angle mounts that they may be used against aircraft.

Next in importance come the anti-aircraft batteries. In the future these guns will be mounted in the highest possible positions and they must have high angles of fire. It is not impossible that they will be mounted on the tops of the masts of the future ships. They will be automatic weapons and will be director-controlled, so that a barrage of bursting shell may be laid in the bombing area above the ship, which may be raised or lowered at the will of the officer commanding the guns. Say that eight 4 or 5-inch automatic guns, firing 60 shots a minute lay a barrage over the ship. Nothing will be able to get through it! If planes attempt to bomb the ship from the level upon which the barrage is located, they will be shot down as they touch its edge. And the barrage can be raised or lowered very quickly to offset a change of altitude on the part of the aircraft. But when dealing with bombing planes of the future, we must not think of a few dozen planes operating in one stratum of air, but of hundreds of planes operating on various strata of air. The idea is that if a single set of planes is lost on one stratum of air, other squadrons operating below or above them to a maximum altitude of 10,000 feet will be able to get in their bombs.

But there are other systems of anti-aircraft defense that will stop planes from doing just this. The weapon involved is the large anti-aircraft mortar. This weapon in the future will probably be a rapid firing 20-inch short gun which throws its shell directly above the ship. And its shell is not of the bursting type which relies upon its fragments to demolish its object, but merely a very thin shell carrying more than a thousand pounds of explosives. When this great charge explodes in the air a tremendous vacuum is created. This vacuum is something on the order of an air pocket. Anything which stumbles into it must drop! There is no air there to sustain it. The effect may be like a collision with a brick wall—this collision with nothingness!

Should the planes be able to drop a few of the most powerful bombs the shells will be arrested by the light armor on the top decks of the ship. Velocity is another word for penetration and aircraft bombs lack velocity. Only by going as high as 60,000 feet could a velocity of 1,200 feet per second be produced; and planes will never go this high for military work. First, because they cannot hit at this altitude because of the many and diverse air currents below them. For this and other reasons, the 10,000-foot altitude will be about the limit at which hits can be secured. At this altitude the planes will be lucky to obtain a velocity of 600 feet per second for their bombs.

Some may argue that planes will some day carry heavy guns. This scarcely seems probable because planes lack stability, in that they ride on something with a very low specific gravity—air. For an analogous reason ships will never be able to successfully bombard properly defended forts. They lack stability as compared to the forts; the difference between the water and land is too great to be counteracted by mechanical means.

The propelling engines of today will have passed within 25 years. The steam-driven engines with their attendant funnels and necessity for large amounts of fuel will be replaced by engines of a semi-Diesel type which, coupled with the electric drive, will give great economy in fuel and ship-space, together with the advantage of being funnel-less. Weight and space will be saved for other purposes.

Strange as it may seem, the capital ship of the future will not necessarily be extremely fast. The slower it is possible to build the ship and have it capable of meeting other ships, the better, as great engines mean great space and weight, which could be well used for offensive or defensive qualities. The battleship of the future, from the present outlook, is not liable to have a speed in excess of 25 knots, though its speedy counterpart, the battle cruiser of the future, may have a speed of well on to 35 knots.

Gas is the most important weapon of today, for the very simple reason that the ships now in existence can not be defended against it. The ships of the future will be air-tight, so to speak, and will be ventilated by several main and a number of independent ventilating systems. Because of the power of modern gases, men will not be on the decks or bridges of future warships in battle. They will be protected, in air-tight compartments.

And the warships of the future will be able to deliver tremendous streams of the most powerful gases. While a warship breathes through its ventilators an airplane breathes through the nostrils of its pilot. And an airplane will be unable to carry the most powerful gases, because the size and weights of the containers will be too great Gas will be a very efficient anti-aircraft weapon of the future.

Today, nearly every battleship carries a small plane for scouting and spotting duties. Some battleships carry as many

(*Continued on page* 807)

Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

No. II—A Journey to the Year 2025

(Author's Note. Science is, in reality, nothing but the prediction of the future. The astronomer, from his knowledge of the past, can predict the position of planets for hundreds of years to come; the chemist knows in advance what substance will result from combining a certain acid with a certain base; and the engineer, in his blue-prints, shows what the appearance of his new machine will be. To forecast what the progress of humanity will be in the next hundred years is too complex a problem to be solved with any degree of accuracy, but certain inventions and discoveries may be readily foreshadowed.)

"YOU'RE a smart man, Doctor Hackensaw," remarked Silas Rockett, "but I'll bet there's one thing you can't do!"

"Indeed? And what is that, pray?" asked the doctor, smiling. "Is it to make Gloria Mundy fall in love with you?"

Silas Rockett blushed. "No," said he, "I don't need any help in that direction. What I should like would be to take a trip a hundred years forward into the future!"

"Is that all?" cried the doctor, gaily. "Why that's easy enough—I'll take you there any time."

Silas Rockett's face fell. "You don't understand me," said he. "I don't want you to put me to sleep for a hundred years, pickled in carbon dioxide, the way you do with other men. No, thanks! What I want is just to take a short run to the year 2025 and then come back to the present time again. If such a thing were only possible, I should come back a rich man!"

"How so?"

"Why, I'd simply take note of some of the greatest inventions that had been made during the century, and patent them now. I'd soon be the richest man in the United States!"

The smile on Doctor Hackensaw's face broadened into a sardonic grin.

"I'll gladly do what you want, Silas;—the thing is simple enough. But, as to making your fortune, I fear you will be sadly disappointed. Do you imagine for a moment that if Ben Franklin had been allowed to spend a few days in our century, and had then gone back to the year 1776, he could have accomplished much? He would know how to make a locomotive, a telephone, a dynamo, an automobile, an aeroplane, and radio apparatus—but of what use would they be? He would have no capital with which to put his machines on the market, no facilities for mining and transporting the coal required, no gasoline for his automobiles and aeroplanes, no business that would warrant the installation of telephones and wireless. No, Silas, a new invention cannot be successfully launched until the world is ready for it. Human progress is necessarily slow. People in 1776, even more than at the present day, were opposed to all innovations, and Franklin would have been long dead before the simplest of these new devices would have been adopted. Every great invention requires a host of preliminary steps, and then there is the arduous work of educating the public up to it. But that's neither here nor there. If you want to make a short trip to the year 2025, I'll send you there at once, and guarantee you a safe return, too."

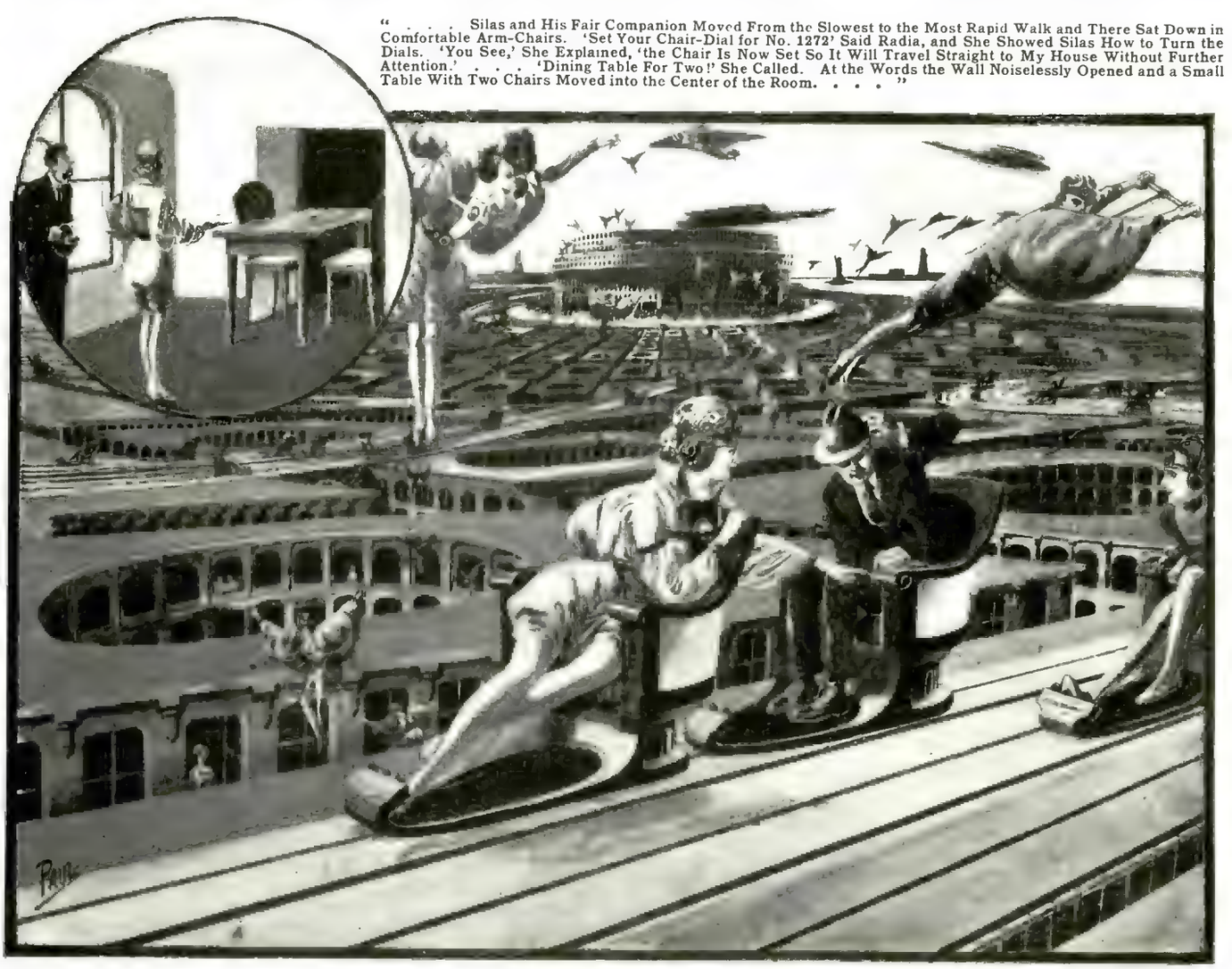
"But how will you manage it, doctor?" asked Silas, surprised.

"Simply enough. I will merely give you an opiate, and by leading your thoughts to the future, as you fall asleep, you will almost certainly dream of the year 2025."

Silas Rockett made a wry face. "What use would that be to me?" said he. "In my dream I should learn nothing new, because a man can dream of nothing he doesn't already know."

"Indeed?" returned Doctor Hackensaw. "You forget that the human brain is a wonderful organ, especially when under the in-

(*Continued on page* 822)



". . . Silas and His Fair Companion Moved From the Slowest to the Most Rapid Walk and There Sat Down in Comfortable Arm-Chairs. 'Set Your Chair-Dial for No. 1272' Said Radia, and She Showed Silas How to Turn the Dials. 'You See,' She Explained, 'the Chair Is Now Set So It Will Travel Straight to My House Without Further Attention.' . . . 'Dining Table For Two!' She Called. At the Words the Wall Noiselessly Opened and a Small Table With Two Chairs Moved into the Center of the Room. . . . "

The Autobiography of An Explosion

By PROF. LINDLEY PYLE

PROF. OF PHYSICS, WASHINGTON UNIVERSITY, ST. LOUIS, MO.

TO most of us an explosion is just a *bang*, but to a technician an explosion is an event involving a lapse of time, accompanied by pressures that vary in a continuous manner. He knows that he is dealing with a phenomenon that may grow from infant to giant magnitude and die away, all in a thousandth of a second, and that it is necessary to trace the history of the event from moment to moment, measuring the actual pressures developed at successive intervals of even one hundred-thousandth of a second. In studies of this nature the explosive forces are usually made to record their values by actuating sensitive apparatus, but, quite obviously, the moving parts of that apparatus must be able to respond quickly, or the dictation will come too rapidly for the automatic stenographer to take it down.

Sir J. J. Thomson has developed a detecting device for the study of explosion pressures that uses a jet of electrons as the movable part, the actuating agent being an electric charge, proportional at each instant to the explosion pressure. Dr. D. A. Keys has put the method to actual test and has obtained most interesting data.

Certain crystals exhibit what are called *piezo-electric* properties, that is, under pressure, they develop electric charges upon their surfaces. Crystals of tourmaline are used in the Thomson device and are arranged as in Fig. 1. A brass pot with steel cover has the crystals, CC, in the bottom, held by an iron plate, HI. A thin lead plate, DE, connects with an insulated wire, F. The crystals are so turned that those faces that become positively charged under compression are all in contact with the lead plate. The bottom of the pot is then filled with vaseline, PP. L is a spark plug with a fine wire, O, between the terminals. N is a stop cock permitting the introduction into the pot of explosive mixtures which are exploded by heating the wire, O, with an electric current. The electrification of the wire, F, is found to follow practically instantaneously the changes of pressure in the pot. Also the electrification is directly proportional to the existent pressure.

The wire, F, is led to the apparatus indicated in Fig. 2, which is essentially what is known as a *Braun tube*, a device exhausted to a very high vacuum and which furnishes, under several thousand volts electrification, a high-speed stream of electrons passing from the incandescent tungsten wire (see F, Fig. 2) through the pinhole O to the photographic plate holder, X.

Fig. 2 will be understood more readily by referring to its simplification in Fig. 3. The cylinder, H, is intensely electrified negatively by connection to the high potential generator, T, and the negatively charged electrons boiled out of the hot wire, F, are repelled from H at possibly 50,000 miles a second, some of them passing through the small hole, O, into the grounded metal cylinder, L, to a photo plate at X, which, upon development, will show the spot where the electrons struck the plate. Now, on its way, the electron stream passes between two plates one of which, M, is connected with the crystals indicated in Fig. 1. If M becomes positively electrified the attraction upon the flying negatively charged electrons will pull the stream down, say, to the position indicated by the dotted line.

Referring again to Figs. 2 and 3, WW is an electro-magnet with a soft-iron core. If a current traverses its coils the magnetic field through which the electrons pass will deflect the electrical stream (or electric current) in a direction at right angles to the deflection set up by the charged plate, M. Using an *alternating current* of known frequency on the electro-magnet, the magnetic field will alternate in direction and the point of impact of the jet of electrons will move to and fro on the plate in a motion like a pendulum bob.

In an actual test the photo plate is exposed, the alternating current is turned into the electromagnet windings, the heating current is turned on the coil within H, and the double key S is depressed which first starts the jet of electrons and then closes the circuit that fires the explosive mixture. The explosion pressure develops an electrical charge on M in exact accordance with the growth and decay of that pressure. The jet of electrons which is swinging to and fro in synchronism with the alternating current field

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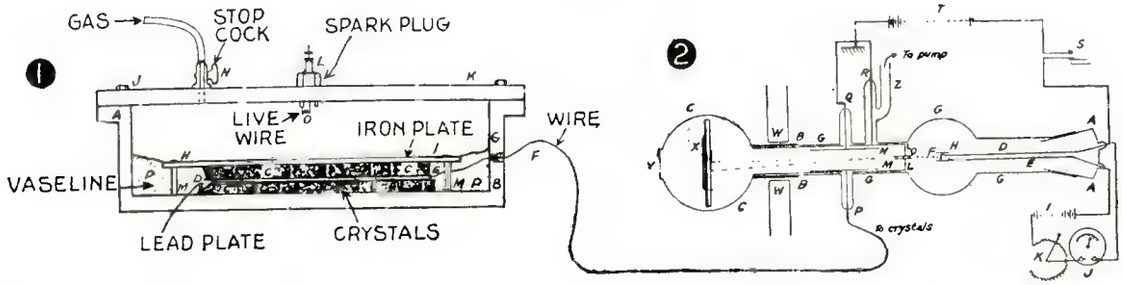
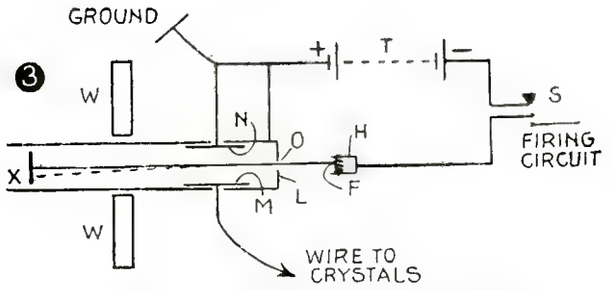
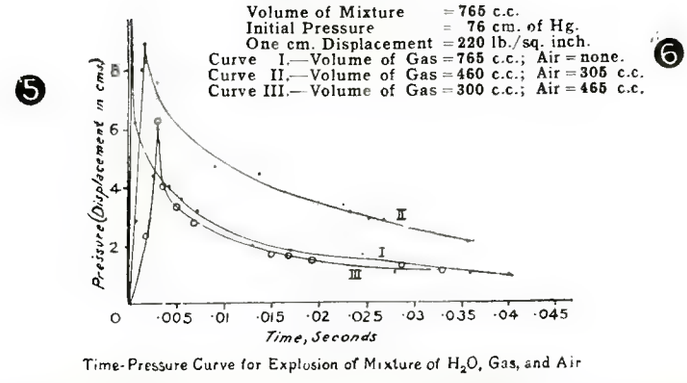





5
Volume of Mixture = 765 c.c.
Initial Pressure = 76 cm. of Hg.
One cm. Displacement = 220 lb./sq. inch.
Curve I.—Volume of Gas = 765 c.c.; Air = none.
Curve II.—Volume of Gas = 460 c.c.; Air = 305 c.c.
Curve III.—Volume of Gas = 300 c.c.; Air = 465 c.c.
Preisure (Displacement in cms.)
Time, Seconds
Time-Pressure Curve for Explosion of Mixture of H_2O, Gas, and Air

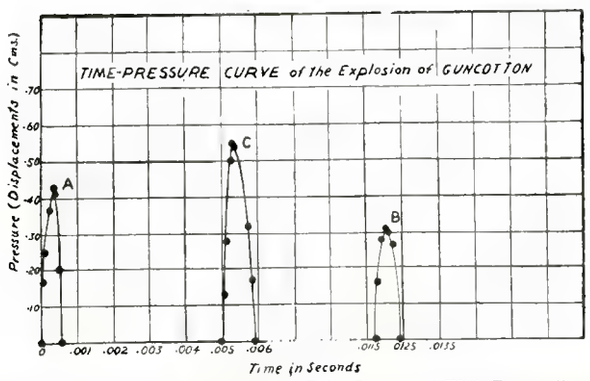


Fig. 1 Shows Metal Chamber Used in Studying the Effect and Nature of Different Explosives. Fig. 2 Shows Braun Vacuum Tube Connected With Tourmaline Crystals in Testing Chamber of Fig. 1, as Well as the Batteries and Other Apparatus. Fig. 3 Shows Simplified View of Braun Tube. Fig. 4 Shows Typical Photographic Record of an Explosion as Produced by the Braun Tube Apparatus. Fig. 5 Is a Graph Showing the Pressure-Time Curves for an Explosion of Hydrogen and Oxygen Prepared by Electrolyzing Water. Fig. 6 Shows Time-Pressure Curves For Three Different Experiments in an Explosion of Gun Cotton.

Pilotless Mail Planes

By H. WINFIELD SECOR

SOME months ago, we heard of a new electric guiding cable in use in France for steering airplanes in foggy weather or at night, the pilot being apprised of the fact that he had departed from the charted route by the difference in sound in a pair of head phones strapped to his ears, the sounds in the phones being due to electric currents induced in a pair of coils placed on either side of the plane. These coils in turn had currents set up in them, due to the powerful electro-magnetic field surrounding the earth conductor, through which an alternating current was passed continually, this charged guide wire being either placed on the ground where permissible, or else supported on poles By using a current of a certain frequency, a distinct and unmistakable musical note is heard in the phones, and the receiving apparatus aboard the plane may be arranged so that when no sound is heard, the plane is flying directly over the charged cable or approximately so, or else the instruments may be adjusted so that an equal sound is heard in both phones; when the sound becomes weaker in one of the phones, the pilot knows that he is departing from his position above the guide wire. By using powerful vacuum tube amplifiers, the guiding note from the charged wire can be heard at an altitude of several thousand feet easily.

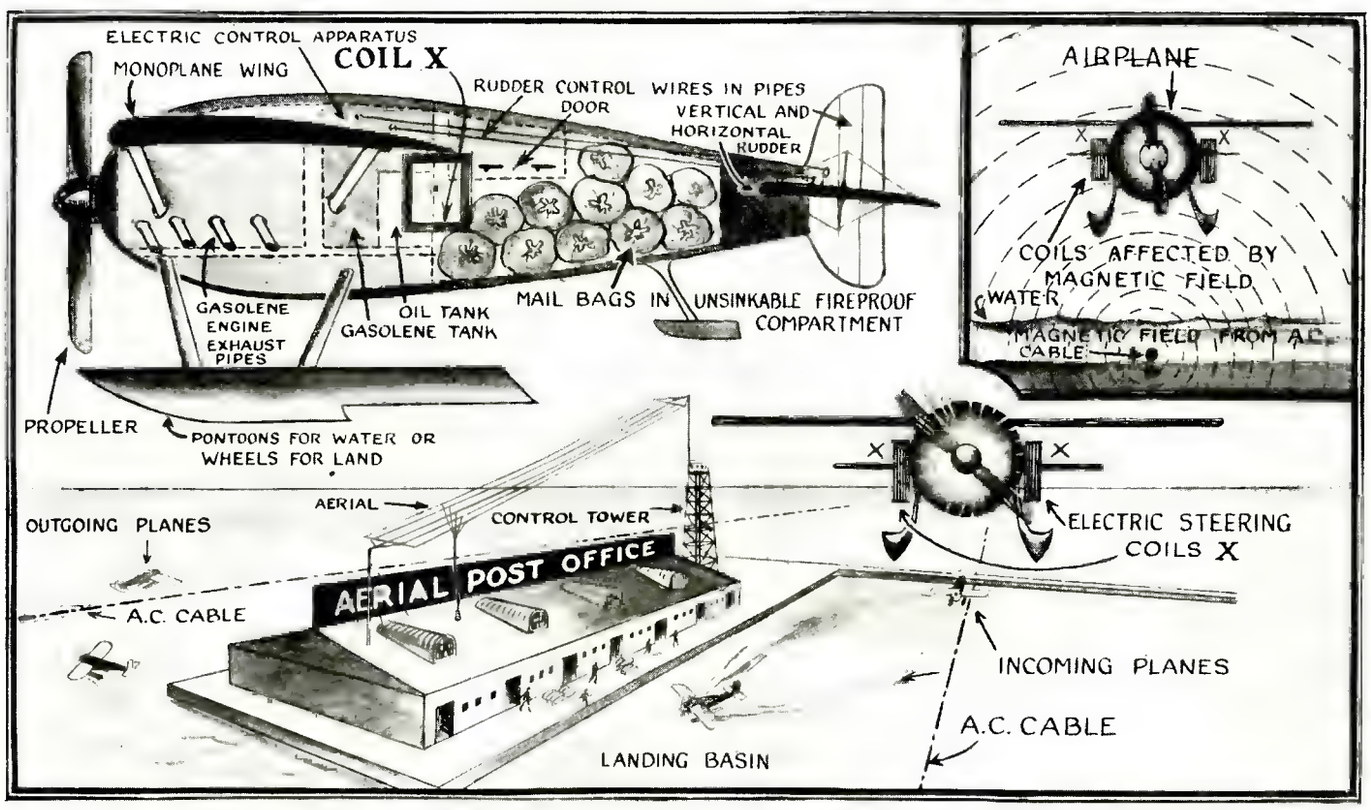
A recent test made in France with this electric guide cable for aircraft, which experiments are being carried on by Mr. Loth, a French engineer, has given promise, it is said, of a system of transporting mail automatically by means of small automatic airplanes, which will fly along their guided courses without a pilot. These special mail transportation planes will have the usual wings, and a special body designed to act as a hull for landing in water, and with a wheel landing gear where they are to land upon or arise from the soil. The body at the same time is made fire-proof, and sufficiently buoyant to prevent sinking with the mail bags, in the event that the airplane happens to fall into the water, if the propelling machinery should fail. The pulsating electro-magnetic field, radiating continuously from the wire along the course to be followed by the mail planes, would hold them undeviatingly on their given course.

The probable design of these automatic mail planes is shown in the accompanying drawing, the usual engine and propeller being placed in the forward part of the fuselage, with a good sized gasoline tank as well as an oil tank. In this compartment or adjacent to it, there is placed the radio control mechanism for operating the horizontal rudder and thus determining the angle at which the plane descends and ascends; the pneumatic or compressed air cylinders and control magnets, together with mercury switch, described in detail in the August number of this journal, for automatically stabilizing an airplane in flight, are also placed in this compartment. It is believed that with a finely designed streamline body, small monoplanes of this type can be constructed, so that a high speed will be obtained for mail delivery, one of these planes covering the distance of 220 miles between London and Paris, in one hour.

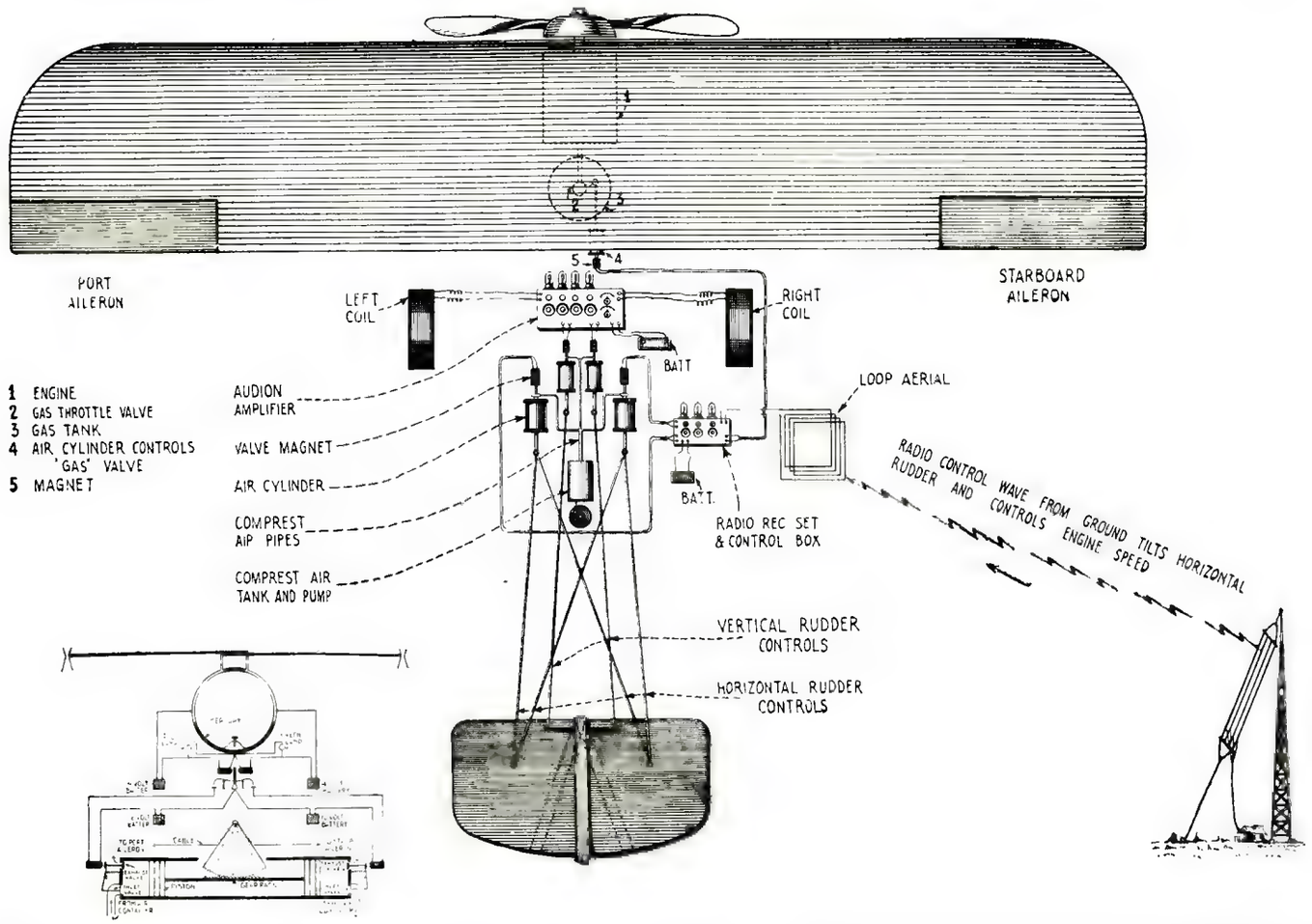
The ailerons or wing tips are automatically controlled by the electro-pneumatic apparatus, described fully in the August number of this journal by G. H. Daly, and a diagram showing details of his scheme for automatically stabilizing a plane is reproduced herewith, in conjunction with the other apparatus to be used in following out the Loth method of steering an airplane over a specified course, by means of a charged electric conductor. The Avilene stabilizer, as it is called, works on the principle that the tipping of a plane sideways causes a mercury column in a tube or channel to close either the right or left hand circuits, and in turn air is led into or exhausted from the long air cylinder shown, and the movement of the piston in this cylinder is communicated to a continuous cable secured to the port and starboard ailerons by means of a gear rack and sector, as shown. The Avilene stabilizer has been tried out in practice, and was found to work with remarkable efficiency.

To keep the plane on a given course, proper control must be had of the vertical rudder at the rear of the plane, and to swing this rudder to right or to left, as becomes necessary, cables are attached to it, and also to a pair of compressed air cylinders, which are placed under the control of magnetic valves for admitting or releasing air to and from the cylinders. These valve-magnets are under the guidance of a vacuum tube amplifier and two *feeling* coils, placed on either side of the fuselage. When the plane is situated directly over the electrified cable, the currents induced in both coils balance each other, and the control mechanism is so arranged that the vertical rudder stays on a straight line, so as to make the plane follow along the wire. Any deviation from the course will be counteracted by the apparatus, which will bring the plane back over the wire.

The horizontal rudder, as seen in the drawing, is placed under the control of a separate set of compressed air cylinders with magnet-controlled valves, and the movement of this rudder, which determines the angle at which the plane rises or descends as well as the height at which it is to fly along the course, is placed in charge of a radio receiving set



The Automatic Mail Delivery Planes Here Illustrated Are Guided Along Their Route by the Pulsating Electro-Magnetic Field, Set Up About the Alternating Current Cable Placed Along the Ground or Submerged in Water, as the Case May Be. The Airplanes Are Caused to Ascend and to Descend at the End of Their Journey by Means of a Radio Control Operating the Horizontal Rudder. The Machine Is Kept on an Even Keel, Once It Has Obtained Its Proper Altitude, by an Automatic Stabilizer Arrangement, Shown in Detail in the Lower Left Hand Corner of the Diagram on the Opposite Page. The Radio Impulses Acting on the Horizontal Rudder Are Sent Out at the Transmitting and Receiving Post Office Stations by an Observer, Who Watches the Planes as They Arise or Descend. Seaplanes or Land Planes Provided With Wheel Landing Gear May Be Employed.



The Various Electrical and Radio Controlled Apparatus for Steering and Automatically Stabilizing the "Pilotless" Mail Planes is Shown in the Diagram Above. The A. C. Magnetic Field Set Up About the Guide Wire Lying on the Ground Acts on the Right and Left Hand Coils, and These in Turn Connect With an Audion Amplifier. The Intensified Currents From the Amplifier Act on Magnetically Controlled Valves, Admitting Air to the Cylinders as Shown, to the Piston Rods of Which the Vertical and Horizontal Rudder Control Cables Connect. Radio Impulses of the Proper Sequence Sent From the Land Station Act on a Radio Set Equipped With a Loop Aerial. When the Selector Incorporated in the Radio Set Transfers These Impulses to the Proper Valve Magnets, Either the Right or Left Hand Air Cylinders Are Actuated and Caused to Elevate or Depress the Horizontal Rudder. A Third Radio Control Current Is Caused to Act on a Magnetic Throttle Valve, So as to Reduce or Increase the Speed of the Engine, as May Be Desired, in Ascending or Landing. The Vertical Rudder Is Operated to Keep the Plane Over the Electrified A. C. Cable by Intensified Currents Coming From the Right and Left Hand Coils Shown. The Drawing in the Lower Left Hand Corner Shows the Automatic Electric Stabilizer Circuits Connected With the Port and Starboard Flexible Wing Members or "Ailerons"; This Was Fully Described in Our August Issue.

of special design, this radio controlled apparatus being actuated by wireless impulses sent from a ground station, and which are picked up by means of a loop or concentrated aerial, placed in the body of the plane.

The action of these automatic planes will be better understood, perhaps, by describing a typical trip. The mail plane having been loaded with oil and gasoline, and also with its cargo, the engine is started by pushing a release button actuating the electric self-starter; and when the machine has attained sufficient speed running along the ground, or over the water if it is built in seaplane style, for this purpose, the chief operator in charge of starting and landing the planes sends out a series of wireless impulses of the proper sequence, which being received on the radio set aboard the plane cause the horizontal rudder to be elevated, and the plane shoots up into the air, climbing steadily. When it has reached an altitude of 1,000 feet, one or more sets of wireless signals are transmitted, so as to bring the rudder back to the normal horizontal position, thus causing the plane to straighten out, and the feeling coils now pick up their control currents from the electrified guide wire, and the plane starts along its journey. It is readily possible today by means of the perfected Hammond, and other types of radio control mechanisms, to have available a separate set of radio impulses for controlling the gasoline throttle valve, and thus reducing or increasing the speed of the engine, as the plane is starting or descending, all of these operations being under the control of the chief operator at the starting and landing field, or basin, if a water landing station is provided. As the plane proceeds upon its journey, it automatically stabilizes itself by the Avilene electro-magnetic stabilizer, previously described.

When the mail plane or planes reach the end of the journey, the operator at the landing station sends out the proper radio impulses to deflect the horizontal rudder, and cause the plane to describe a downward course to the landing field or water-basin. The automatic control of aircraft may seem somewhat problematical and theoretical to the average person today, but with the radio control apparatus now in the hands of military and naval experts, it is quite certain that in the war of tomorrow, wirelessly controlled aircraft will be used for dropping high explosives on cities and ammunition stores, in order to blow them up.

Doubts if Betelgeuse Is Solid Throughout

The bigness of Betelgeuse does not lie in its body, but in the immense extent of the luminous atmosphere which surrounds it, according to the theory recently advanced by M. Verronet, the astronomer of the Strasbourg Observatory, at the Congress for the Advancement of Science, held in France.

M. Verronet frankly stated his belief that no star as big as Betelgeuse could exist in a solid mass. According to the measurements of Professor Michelson at Mt. Wilson Observatory, it is 300 times greater in diameter than the sun, with a circumference greater than the whole orbit of the earth, whereas Sirius, the most brilliant normal star in the sky, is only twice as big as the sun.

Mr. Verronet cited measurements of other giant stars, such as Antares, which has forty times the diameter of the sun, in support of his theory. The established laws, he said, did not admit an explanation of the physical equilibrium of these giant stars, and he quoted determined laws of correlation, mass and temperature to show that in no case could one of these giant stars exceed in actual mass two or three times the size of the sun.

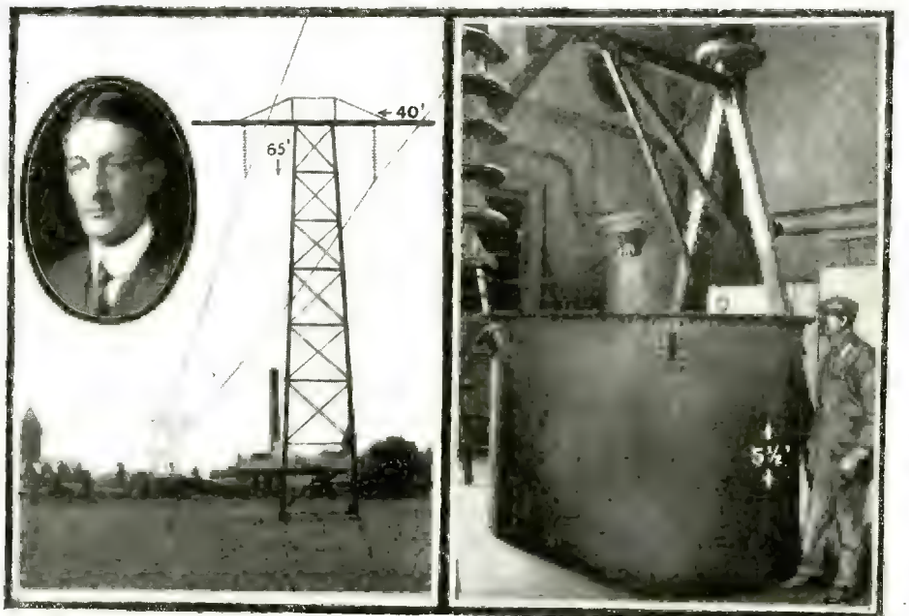
What gave them their gigantic appearance, he said, was that their mass was surrounded by an immense luminous envelope forming a photosphere. Something analogous to this envelope, but much less brilliant, was to be found in the sun's corona. If an effulgent photosphere stretched beyond the sun's atmosphere at the level of the corona, something like a giant star of the Betelgeuse kind would be produced. But to produce this effect the sun's superficial heat would have to be raised to 300,000 degrees. An outside stable envelope with diameter equal to 300 times that of the sun would then be formed.

Ultimately, says M. Verronet, these giant stars become normal as their envelopes contract with the decline of heat, turning successively yellow and blue.

600,000-Volt Transmission Line

AN experimental transmission line for operation at 600,000 volts, the highest voltage line in the world, has recently been completed at Purdue University. Little is known about high tension transmission in excess of 220,000 volts, so the engineering experimental station of Purdue has begun work to obtain definite data.

The new transmission line is based on the design by Ross Lake, but was modified considerably by Prof. C. F. Harding, head of the Electrical School. The line is 1,700 feet in length and consists of three 600-foot spans of steel core aluminum cable, supported on four steel towers 65 feet high. The crossarms are 40-feet long, and the 15 unit suspension insulators are hung in such a manner that they may be readily moved in different directions from 16 to 40 feet without taking down the cables.



Left: General View of 600,000-Volt Transmission Line in Rear of Purdue University Power Plant. Insert: Prof. C. F. Harding, Head School Electrical Engineering at Purdue. Right: One of the High Voltage Transformers, and Drum Used in Regulating Voltage.

The voltage is controlled by means of an auxiliary transformer and double drum, motor-driven controller which provides 480 equal steps without distortion of the wave form.

The first study to be undertaken with this high power line is the corona losses. The corona is the glowing discharge which is seen coming from electrical conductors when they are heavily "loaded," and really represents a loss in energy.

"Little is known about the phenomena of corona losses at potentials above 220,000 volts," said Prof. Harding. "As it is probable that voltages far in excess of that value will be used for power transmission in the future because of the greater development of coal mines and hydro-electric stations at a great distance from available markets, it is believed that this line at Purdue may prove of great value in these pioneer investigations."

New and Useful Devices

THIS clothes brush is made with a hollow aluminum top and uses a specially refined turpentine. This brush can be used for one's clothes and when brushing out the dust it also removes any spots on the same.

You are to cut down your ice bills by using an original water or wine cooler without ice. The photograph shows this simple instrument, the details of which are seen in diagram. The cooler is introduced through the neck of a carafe or wine bottle and put under a faucet. In ten minutes your water is ice cold. Now look at the diagram. Water passes down tube (A) issuing at (B) and coming up again through outer tube (C), and on reaching (D) forms fountain falling over sides of carafe without entering. The combined falling drops and air movement makes the falling water cold, and thus cools the water or wine in the carafe.

The combination flashlight and revolver shown below should be very effective. It is the invention of S. P. Cottrell. Mounted upon an ordinary flashlight is a very small chamber which houses six 22-caliber steel-nosed revolver cartridges. The trigger is of the invisible type, disappearing into the case of the flashlight when not desired, and it is held there by a spring catch. The device is hammerless. A side ejector automatically throws the empty shells out after they have been fired. At short range this revolver is rather effective, striking close to the center of the flashlight beam. It is very easily handled and weighs but a fraction more than the regular flashlight. Being ready for use at a moment's notice, it becomes a remarkably good weapon against thugs or other intruders who, if they do not see a gun in the owner's other hand, would naturally believe him to be unarmed, as the attachment is quite invisible when viewed at a distance. Training the beam of light upon an attacker insures his death when the trigger is pulled.

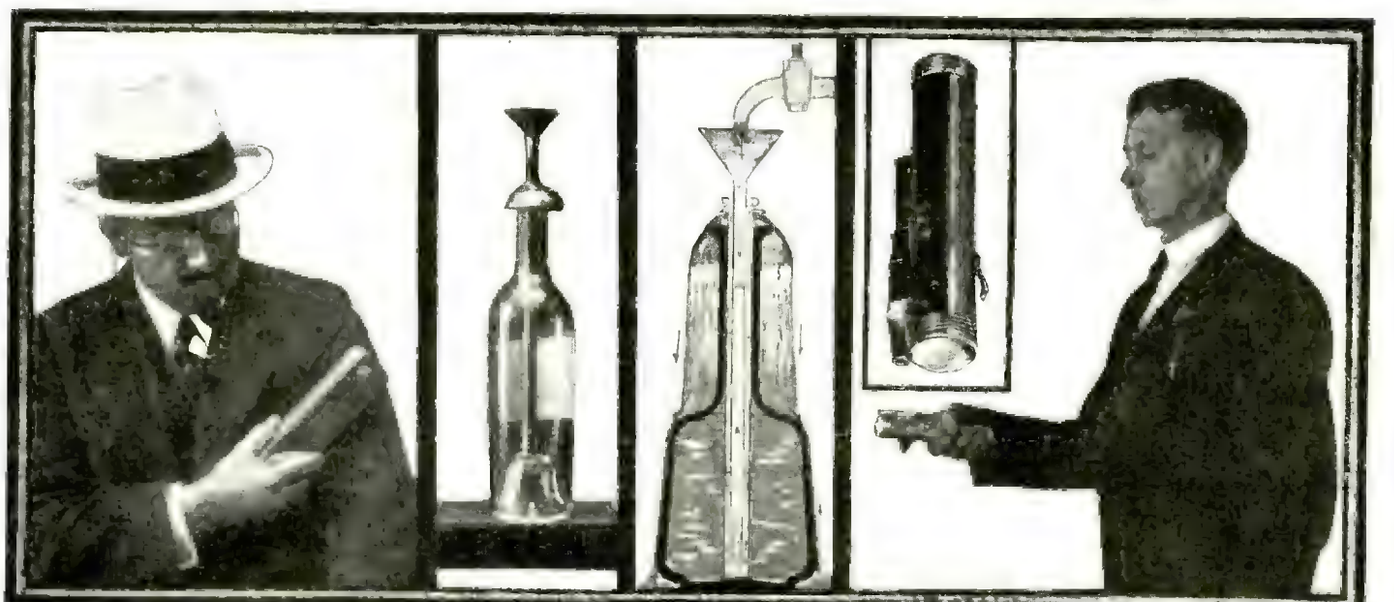


Photo at Left Shows New Hollow Clothes Brush Which can Be Filled With Turpentine so that Spots on the Cloth Will Be Removed at the Same Time. They can Also Be Used for Brushing and Cleaning Upholstery, etc. The Two Cnter Photos Show New French Water and Wine Cooler. The Water from a Spigot Passes Down Tube A, Up Tube C, Thence Down Over the Outside of the Carafe. Photo at Right Shows New Flashlight-Pistol, Firing Six Shots. It Is Extremely Accurate, as the Bullets Strike in the Center of the Light Bulls-eye.

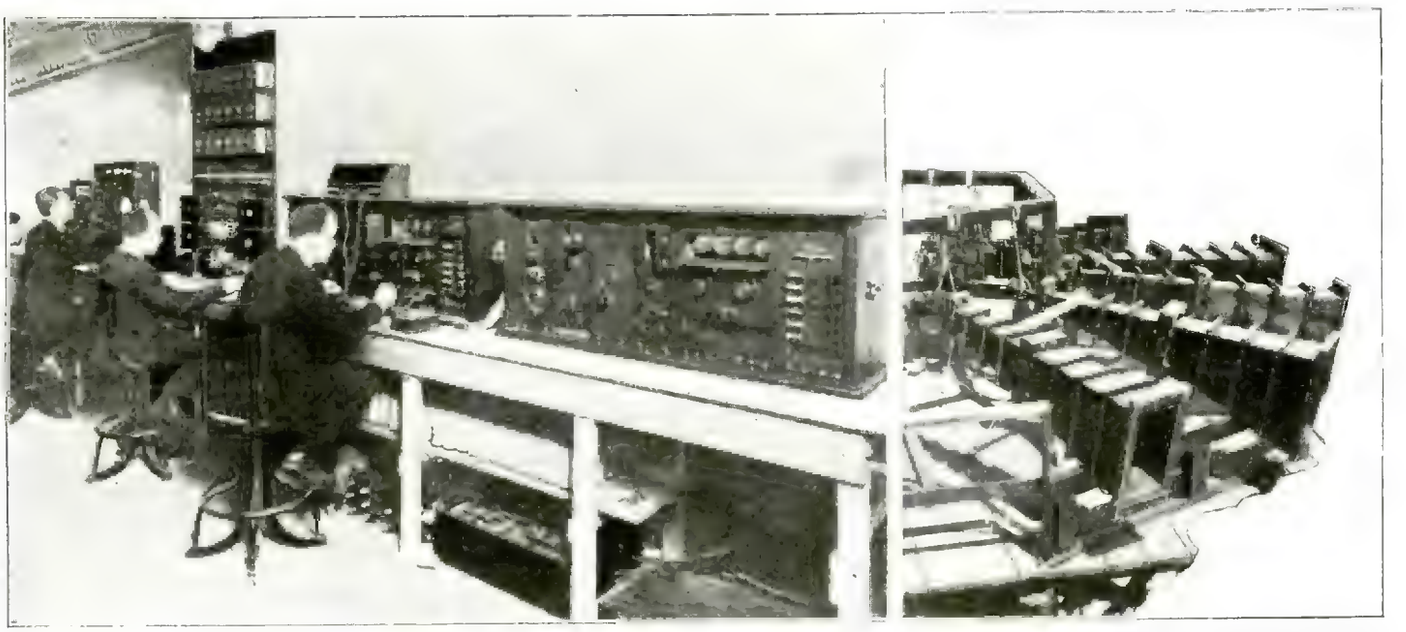


Photo at Left Shows Loud-Speaker Control Room With Amplifier Tube Cabinets. This is Only a Part of the Apparatus Used to Operate the Gigantic Amplifier Fitted With Several Long Wooden Horns, Shown Close-Up at the Right, When a Large American Electric Company Arranged to Have Their President Speak From New York City to 27,000 Employees Grouped Together at the Factory Plant Near Chicago.

World's Largest Speech Amplifier

ONE of the most powerful speech amplifiers ever constructed was erected at the plant of the Western Electric Company near Chicago, where 27,000 employees recently gathered to hear their President talk from New York City over a 900-mile telephone line, his voice finally booming forth in thunderous volume from the large wooden horns here shown. The photo at the left shows the loud-speaker control room with the main vacuum tube amplifiers and switch panels, to which lead wires from the amplifiers, transmitters, and projectors, including the telephone circuit coming from New York, were brought and interconnected. The apparatus shown in this room is only a part of that actually used in operating the large amplifier.

A good idea of the construction of the amplifier horns, is obtained from this photo, these being built of substantial boards strengthened at frequent intervals by battens or ribs secured around the outside of the horn chamber. Contrary to the opinion of many experimenters, such horns are not the most efficient when built from thin lumber, but are best constructed of substantial heavy boards so that they cannot vibrate. This idea of permitting only the column of air enclosed within the horn to vibrate, was enunciated some time ago by Professor Dayton C. Miller, well-known American scientist, and authority on acoustics. This law holds as well for phonograph amplifying horns, and loud-talker horns for radio sets. The telephone reproducer mounted at the small end of each wooden horn, here shown, is a specially devised high powered instrument, capable of translating a very strong telephone current into sound-waves, without distorting the speech. Where a large number of people are to listen to loud-talkers, it is the best idea to use several horns, as here shown, and place them at an angle to each other, so as to embrace a circle or whatever part thereof becomes necessary.

New Science Wrinkles

NEW AUTO LOCK FOR FORDS

This new lock made entirely of tough steel with a glass hard surface is a real aid to the policeman. When locked it covers the hub of the steering wheel and grips all four spokes. A glance will tell whether or not it is locked. The lock screws on in place of the steering gear cover and can be installed with a wrench and a hammer in five minutes. The arrangement of the standard Ford parts is not changed and there are no plungers or inside parts that can get out of order or accidentally interfere with the steering. The key slot is above the wheel and in front of the driver, so there is no fumbling around with the key.

HOME RECORDING PHONOGRAPH

The disc is a plastic metal alloy, soft enough to receive the sound vibrations and resisting enough to withstand the weight of the reproducer needle.

It is provided with a volute spiral groove about the same as a regular musical record, but minus the music or song. The record is made by vibrating the needle laterally in the bottom of this groove.

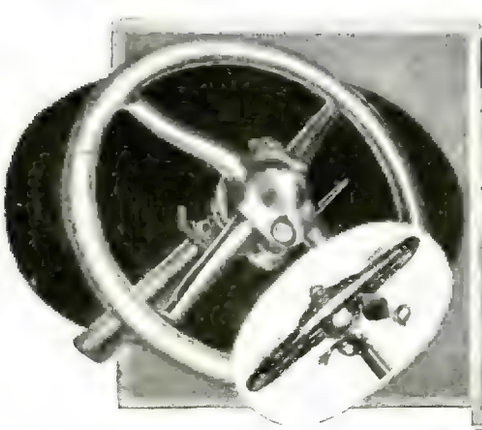
Contributed by ALEXANDER H. KOLBE.

CLEVER ARTIFICIAL HAND

The artificial arm and hand illustrated here can do a variety of things. A man with this arm can saw wood; take out a match from a match box; light a cigar with it; take a glass of water; carry a 75-pound satchel; pick up a pin; and, as a matter of fact, it can accomplish nearly everything that the human arm and hand can do.

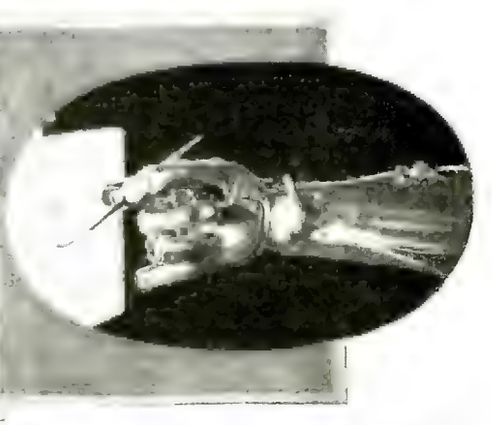
One demonstration, it is claimed, will convince the most skeptical person of its value. It is sorely needed by those who have been unfortunate enough to have lost an arm, either in the war or in industrial plants.

In the illustration it will be seen that the fingers not in use assume a natural position out of the way of the work being done, as each finger works individually, the same as in the human hand. No special tools are required to fit this hand.



Simple New Lock for Ford Cars.

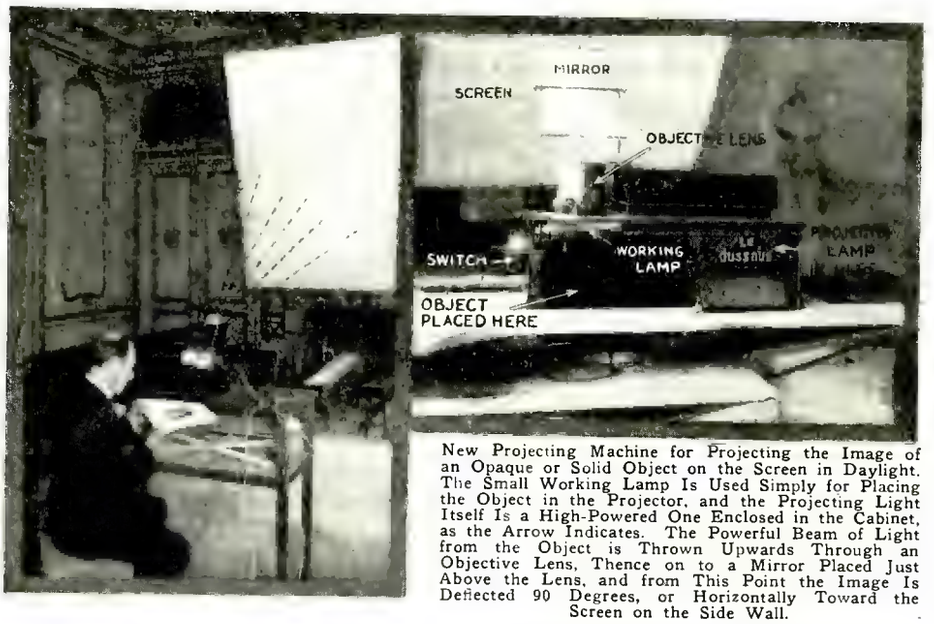
A New Home Recording Phonograph Disc; Irving Kaufman is Shown Recording His Own Voice.



Wonderful New Mechanical Hand Which Duplicates Nearly All the Movements of a Human Hand.

Projecting Opaque Objects in a Lighted Room

By E. WEISS



New Projecting Machine for Projecting the Image of an Opaque or Solid Object on the Screen in Daylight. The Small Working Lamp Is Used Simply for Placing the Object in the Projector, and the Projecting Light Itself Is a High-Powered One Enclosed in the Cabinet, as the Arrow Indicates. The Powerful Beam of Light from the Object is Thrown Upwards Through an Objective Lens, Thence on to a Mirror Placed Just Above the Lens, and from This Point the Image Is Deflected 90 Degrees, or Horizontally Toward the Screen on the Side Wall.

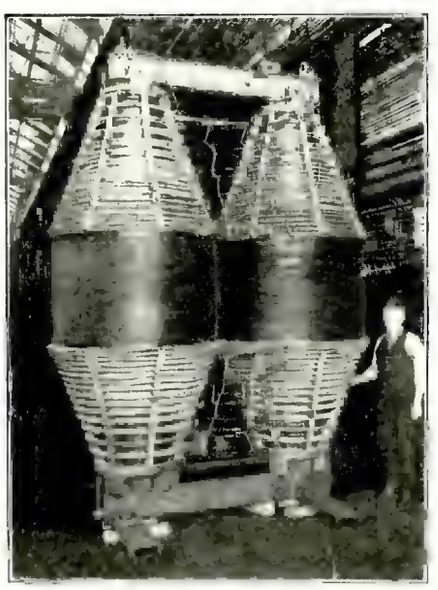
MR. E. BRANLY, of radio coherer fame, presented this invention to the Academy of Sciences. This projection lantern will give a view on the screen in a room, sufficiently lighted for students to take notes. More than this, it projects engravings from a book, living insects and similar opaque objects. The object is placed on the table, which can be raised and lowered, so as to subject the object to luminous rather than to heating rays of light. A five candlepower lamp is used for the placing of the object, which is then illuminated by the large lamp and reflected by an inclined mirror upon the screen, considerably magnified.

The apparatus has been tried in the Louvre (Paris) schools. In this lecture transparent glass slides were not used but were replaced by photographs from the great Doucet collection, the finest in the world, by books from the library, also by gold medals and jewels from the great Jean Morin collection.

One of the results was that 3,000 students were enrolled in one month. Lectures had to be repeated four times, some in the evening at 8:00 o'clock and some on Sunday mornings. All interested in art, from artists to amateurs and workmen, were greatly delighted with these exhibitions which showed objects in their original colors.

It is even held that this invention by M. Dussaud has a considerable moral value beyond the dreams of its inventor, who ought to be certainly pleased, because this apparatus adds a new stone to the fabric of French science and endows his country with a new industry, and puts at our command the most marvelous instrument of teaching and education ever hitherto known.

Highest Voltage Transformer



Note the Size of the Man Standing Alongside of This Gigantic One Million Volt Transformer, Which Is Rated at 1,000 Kilowatts. The Windings of This Transformer Contain Nearly Seventy Miles of Wire.

The transformer shown in the illustration, which is 1,000 kv-a., capable of delivering 1,000,000 volts above ground, was built for the Westinghouse Electric & Manufacturing Company's experimental laboratory at Trafford City, Pa. It is believed to be the only single transformer of such high above ground voltage in operation.

The windings of this new transformer contain nearly 70 miles of wire, divided into many cylindrical coils, each coil wound on a micarta tube. As the coils increase in diameter, they shorten in length, as does a condenser bushing. The turns of copper in the transformer take the place of the tinfoil in the condenser bushing.

The two sets of windings are cross-connected so as to produce increasing voltage from the inner to the larger diameter coils.

The windings of the large diameter or line coils consist of cable covered with treated cloth, so as to withstand surges that are produced when the apparatus being tested flashes over. A condenser bushing is used for bringing the line lead out through the cover of the tank.

The transformer is built on the principle of distributing electrostatic stress as developed by C. L. Fortescue about eight years ago.

The terminal bushing is the largest ever built in the Westinghouse shops, and on this account special machines had to be fitted to turn the bushing. Its length is 19 feet and it is 41½ inches in diameter, and weighs about 9,000 pounds. The static shield is 10 feet in diameter and 20 inches deep.

A Futurist Music Box

Through the medium of a newly invented music box, the inventor has introduced what he terms *futurist music*. An ordinary box which contains intricate machinery reproduces the rustling of the leaves, the rising winds, the chirping of birds, the song of the frog and many other natural sounds.

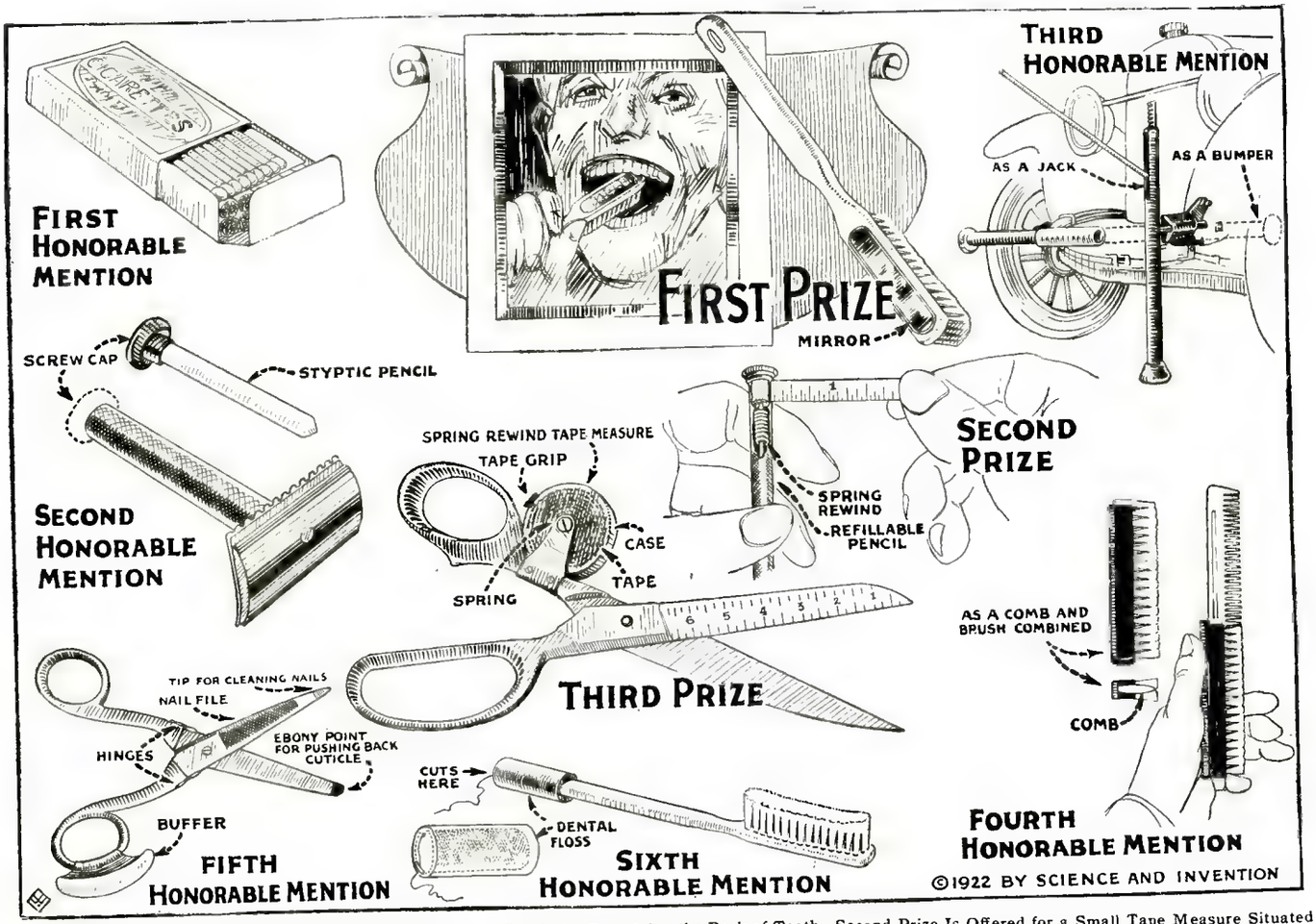
The music box is controlled by a series of gears operated by turning different handles to produce those sounds desired.

The accompanying picture shows the inventor with one of his futuristic music boxes.

This music box makes it possible to produce all sounds needed for the stage or the cinema from one unit. The music box costs less than an orchestra or an organ and is more efficient than either.

Contributed by ALEX H. KOLBE

BRRR



The First Prize Award Is a Mirror Attached to the Back of the Brush, for Examining the Back of Teeth. Second Prize Is Offered for a Small Tape Measure Situated On the End of a Pencil. Third Prize Is Offered for a Combination of a Tape Measure, Scissor and Ruler. First Honorable Mention Is Issued for a Cigarette and Match Box; the Second Honorable Mention for a Safety Razor and Styptic Pencil; Third Honorable Mention for a Combination Bumper and Jack for Automobiles; the Fourth Honorable Mention for a Comb and Brush to be Used Independently or in Conjunction With Each Other; the Fifth Honorable Mention for a Combination of Scissors, File, Buffer and Cuticle Cutter, and the Sixth Honorable Mention for a Tooth Brush and Dental Floss Combination.

"Combination Contest" Awards

IN the September issue of this journal we announced a contest for combination devices, offering three prizes for the best ideas in combination devices made of two or more ordinary everyday things.

Although many of the ideas forwarded to this magazine were extremely ingenious, there were quite a few contributors who did not adhere to the spirit of the contest, in that they forwarded suggestions which were not combinations of everyday devices.

FIRST PRIZE

A device that could be used by every man, woman and child was selected by the judges as being worthy of the first prize. This was one of the fifty or more different devices submitted by Harry N. Butz, of Mazomanie, Wis. Each individual suggestion forwarded by Mr. Butz was typewritten on a sheet of paper, accompanied by a neat ink drawing. We take this opportunity of commending Mr. Butz's method of submitting the manuscripts. This tooth brush has a mirror mounted upon the back of the brush, preferably recessed into the same. The owner of this combination is thus enabled and encouraged to examine the condition of the rear surfaces of the teeth. Very few people do that today, primarily because of the fact that small mirrors such as are used by dentists are not found in the household. Placing a mirror on the back of the tooth brush as demonstrated in the illustration here gives each tooth brush user his own individual mirror. The cost of these devices will not be much greater than unmirrored tooth brushes. The mirrors could be made interchangeable and would preferably be of metal, although glass mirrors set into bakelite or celluloid brushes would serve the purpose. Mr. Harry N. Butz receives $25.00 for this suggestion, which was the first prize awarded.

SECOND PRIZE

The $15.00 award for the second prize in this contest is being sent to Mr. John Weaver, of 2706 Toledo St., Corliss, Pittsburgh, Pa. This is for an ever sharp pencil with a small tape-measure concealed in the end. It is very good for odd measuring, and although a spring to rewind the tape-measure is not absolutely necessary, such a spring could be employed, and might be located in the barrel of the pencil just below the tape-measure, instead of within it as is the usual practice. In this manner the size of the tape-measure container could be greatly reduced. If this small attachment is inserted into a plunger pencil in the position usually occupied by the eraser, the device will more than serve its purpose.

THIRD PRIZE

For a combination of scissors, ruler and tape-measure, forwarded by C. S. Chessman of 495 Sussex St., Ottawa, Ont., Canada, the third and last prize of $10.00 is given. One of the blades of the scissors is marked off in inches so that the user can see exactly how long the cut will be without previously measuring and marking the same. If it is desired to cut a greater length of cloth the tape-measure located on the handle is drawn out and measurements made in the usual manner. This device is ingenious because the tape-measure will, at all times, be on hand when required.

FIRST HONORABLE MENTION

For the best of the group of cigarette boxes and match combinations the first honorable mention is awarded to Mr. James L. Imray, of 111 Girouard Ave., Notre Dame de Grace, Montreal, Canada. A double fold in the front of the inner sliding compartment provides for a space for the matches. In opening the package of cigarettes the top flap is pushed up, both cigarettes and matches appearing at the same time. A striking strip is attached to the side of the cigarette package. The additional cost of manufacture of such a device is very low.

(We wonder whether the package of cigarettes forwarded by Mr. Imray was intended for the editors. Well, they're gone. Thanks old man. Editor.)

SECOND HONORABLE MENTION

A combination, safety razor and styptic pencil, also submitted by Mr. Butz, the winner of the first prize award, is worthy of the second honorable mention. The handle of the safety razor is hollow and contains a styptic pencil secured to a screw-cap. Of course, individuals using the safety razors are not expected to cut themselves, that is the reason we call them Safety Razors. Nevertheless, scratches occasionally occur, and the styptic pencil comes in handy. In this way there is no fear of it straying from the razor.

THIRD HONORABLE MENTION

The third honorable mention is a combination of a bumper and jack for automobiles which was patented by Dr. G. Sjolander, of

(Continued on page 815)

Build Your Own Reflecting Telescope

AT A COST OF $26.30

By C. E. BARNS

Member American Astronomical Society, American Association of Variable Star Observers, Etc.

PART I—GRINDING AND POLISHING REFLECTORS

RECENTLY a gentleman of my acquaintance surprised me with the range and accuracy of his astronomical knowledge. A little later he further surprised me, on looking at the heavens through my telescope, by remarking, "This is the first time I have ever seen the stars through anything larger than a field-glass. Since I was nine years old I have been interested in astronomy—read everything I could lay my hands on relative to the subject—but, although I have been successful financially, I have never felt that I could afford a telescope of a sufficient aperture to satisfy my longings. I have found that such an instrument as I would want, costs in the neighborhood of a thousand dollars; and although I have seldom seen the time in recent years when I could not raise that amount for any purpose I saw fit, to expend so much on an intellectual hobby has never seemed quite expedient. Hence my resort to books, photographs of celestial wonders, an occasional illustrated lecture, and—a field-glass. Perhaps some day——" he faltered, regretfully.

"Why not build your own?" I interposed. "This reflector through which you have seen the marvels of the moon in first quarter, the belts and moons of Jupiter, the crescent of Venus, the rings of Saturn, the snow-caps of Mars, not to mention some of the stellar wonders—clusters, nebulæ and multiples—was built by myself through sheer exercise of ordinary skill and ingenuity, a resolve to get up an hour earlier each morning for a few weeks, and at a total expenditure of twenty-six dollars and thirty cents. What I have done you yourself or anybody else may do quite as well or perhaps even better. Why don't you try it?"

"I certainly shall—beginning at once," said my friend with new enthusiasm. "Tell me all about it."

So herein I have set down the main points of reflector-building, which, if followed carefully, should lead to success. I have started novices, young and old, in the delightful pursuit of telescope-making, and from what I hear of the work of some of my recruits, their mentor himself must look to his laurels. For, as in every other kind of delicate work into which a man throws himself heart and soul, each individual craftsman sees opportunities for improvement in designs and methods, exercising his particular ingenuity; and herein lies the charm of the work.

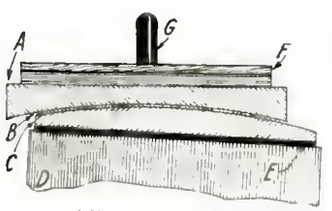
Two things I have always advised from the outset—not to begin too modestly as to size of instrument, and not to wait till after completion of the grinding and polishing of the speculum before undertaking the mounting. As to the first of these, a six-inch mirror requires as much work to construct as an eight or ten-inch one, and gives far less satisfaction. It must be remembered too that magnifying power increases with four-fold

(*Continued on page 792*)

Photograph of Ten-Inch Home-Made Reflecting Telescope, and the Man Who Built It, Mr. C. E. Barns, Describes Here In Exact Detail Just How to Build One Yourself At a Cost of Approximately $26.30. The Detail of the Eye-Piece and Base Support are Clearly Shown in This Photo.

A = Speculum
B = Abrasive
C = Glass tool
D = Grinding Post
E = Pitch
F = Circular wood support cemented to mirror
G = Handle

A = Wooden end of tube
B = Support of speculum with four adjustment screws.
C = Speculum.
F = Newtonian flat in wire mounting.
F = Eyepiece



After Grinding
Greatly exaggerated

Wax-covered polishing tool showing method of laying of squares. In parabolizing these squares are pared down to half size except in centre in order to hollow out centre of mirror, as explained in text.

A = Pin-hole star box with electric bulb suspended opposite hole to represent a star.
B = The operator's eye brought close to razor-blade edge.
C = Knife-edge.

FOUCAULT KNIFE TEST TO DETERMINE PARABOLOID FIGURE AT CENTRE OF CURVATURE

Several Details of the Ten-Inch Astronomical Reflecting Telescope Are Given in the Drawings Above. The Author Explains in Minute Detail All of the Various Stages To Be Followed and Specifies the Materials Necessary in Grinding and Polishing a Ten-Inch Reflector.

A Loud Report Was Followed Almost Immediately by the Crashing of Glass, and the Hollow Thud of the Bullet as It Flattened Itself Against the Steel Plate. Water Trickled From the Edge of the Table. The Magician Had Obviously Sent a Bullet Through the Body of His Assistant Without Causing Her to Even Wince With Pain.

The Amateur Magician

By JOSEPH H. KRAUS

IT was a rather glum day, the sun after repeated efforts to penetrate the veil of mist and fog which overhung the city, had given up its attempt. I had just been settling myself down to the work on hand when the wailing peal of the telephone bell aroused me from a semi-stuporous condition.

"Hello." It was Hargrave's voice. I recognized it immediately. Professor Henri Hargrave, as you will recall, is a well known magician, whose original magical creations are being presented serially in this magazine.

"Hello," he repeated, and when he learned I was at the opposite end of the line, continued, "I'm going to be quite busy toward the latter end of the week, so if you want some new stunts for your next paper, you had better run right out here. You will find me at my home. The next train leaves the depot at 10.10, so you had better speed it up." Without even awaiting my reply, he hung up the receiver.

I, of course, was only too glad to get away for a few hours, and in eighteen minutes I was speeding outward on the tracks of the Long Island Railroad.

Having reached the now familiar residence, I was ushered into Hargrave's presence. On the library table were a number of rifles which the master magician was evidently cleaning. Pointing toward a chair, which I accepted, Hargrave said:

"I am about to show you one of the most spectacular stage tricks which has ever been produced. As a matter of fact, I believe it compares favorably with the well-known 'Sawing a Woman in Half' stunt, which took the country by storm a little

Shooting Through A Living Person

over a year ago. You are without a doubt, acquainted with rifles, and you also understand bullets, I presume?" I acquiesced. He lifted an automatic pump rifle from the table and placed it in my hands, a box of .22 caliber bullets was now opened and pushed toward me. Just then his secretary tripped lightly into the room. "Did you ring, sir?" she inquired.

"Yes, I want to show this gentleman that new stunt of mine. Just come this way, please." So saying, he placed her in front of a steel plate, covered on the outside with asbestos, upon which a target was painted. Between the target and the girl's back a small table was pushed, and upon this was mounted a glass full of water. While he was doing this, I was filling the automatic rifle with .22 long bullets.

"Have you the gun ready?" he inquired. I ejected one of the cartridges, which I retained, and handed the fully loaded gun to him. He lifted it to his shoulder, aimed and then lowered it again, placing it upon the table with the other rifles. He then walked over and shifted the girl's position slightly. Coming back to his original position, he picked up the rifle again and carefully levelled it. A minute target below the girl's chest was the point toward which the rifle was being sighted. I was visibly nervous, in fact I jumped up, grasped the gun, and turned it away.

"Man alive, what are you trying to do, kill the young lady?"

"Tut, tut, Old Timer, you don't see her raising such a fuss at being shot, do you? Now you let me alone for a moment." He raised the rifle for a third time. There was a deafening roar followed immediately thereafter by the shattering of glass. Slowly the girl stepped aside, the water from the broken tumbler pouring down upon the carpeted floor. Hargrave stepped forward and pried the bullet out of the asbestos sheet, handing it to me. I was too dumbfounded to speak. "That's the X-ray bullet," the magician explained. "Goes right through your body and you never feel it." It took me a few moments to recover my sangfroid, and obtain the explanation which follows herewith in Hargrave's own words.

"Didn't it strike you as being rather strange that a girl with a lace dress on should have a leather belt strapped around her waist? Well that leather belt secured the outfit necessary for the successful duplication of this stunt, but of course, in regular performances it would not be in evidence. In the small of her back is a rectangular steel block, which has been attached to this belt by means of two long projecting lugs; the block and belt recall the manner in which a wrist watch is strapped to the wrist. Drilled through this steel block is a hole which houses a twenty-two calibre short cartridge. The trigger is fastened over a vertical hole, which hole penetrates the steel block at right angles to the bore. This trigger is shaped as shown in the illustration, so as to line up with the vertical hole at its driven end, and its point centering over

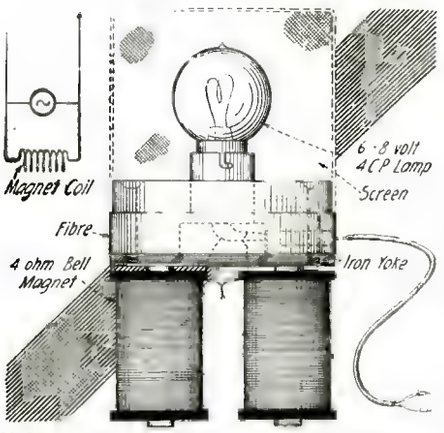
(*Continued on page* 806)

MOTOR HINTS

FIRST PRIZE $5.00
MAGNETIC TROUBLE LIGHT

In the accompanying illustration is shown a motor kink which I have used for some time with great success. This trouble light stays where you put it. I used an old bell magnet and fitted to it a fibre disk of sufficient thickness to accommodate a standard auto head-light socket, as the drawing shows. It takes but little current and sticks anywhere, either on the engine, mudguard, under the car, on the frame, etc. The lamp is connected on parallel with the magnet coil.

Contributed by EVERETT ACKERSON.



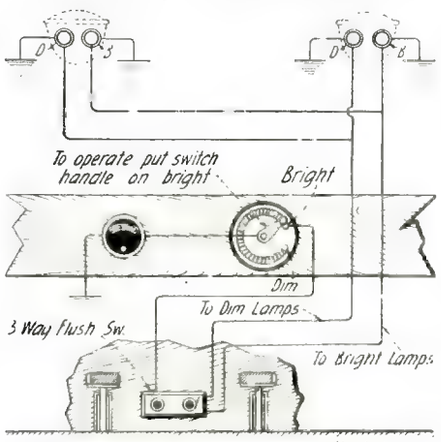
Making Your Own Magnetic Trouble Light. It Sticks Wherever You Put It as Long as the Magnet Poles Rest Against Iron or Steel. An Old Bell Magnet or a Pair of Telegraph Sounder Magnets Are Mounted Together With a Lamp Socket and Protective Cage or Other Housing, as Shown.

SECOND PRIZE $15.00
FOOT SWITCH DIMS LIGHT

Herewith is a sketch showing how I installed a switch on my car for changing the headlights from bright to dim and vice versa, without raising forward in the seat, or removing hands from steering wheel, which becomes very tiresome in heavy traffic.

All that is needed for this device is a three-way switch, such as used in house wiring, and a loom sheet iron box and flush plate. Cut holes in flooring between brake and clutch pedals, just large enough to hold loom box with switch inside. Attach wires to terminals and run up back of instrument board, and cut in on light wires just back of switch, as per sketch. Screw on flush plate to keep out dirt and the job is complete. This device is very easy to operate, as a slight sliding motion of the foot is all that is necessary to change the lighting.

Contributed by WALTER MARKOWSKI.



One of the Best Ideas For Dimming Headlights We Have Seen in Some Time, Is That Here Proposed by Mr. Markowski—the Dimming Switch Is Manipulated by the Foot.

NOTICE TO CONTRIBUTORS

KINDLY note a change in this contest. For the coming months we would like to receive from our contributors articles on the following subject:

ELECTRICITY ON THE CAR

We believe that there are hundreds of new electrical ideas that can be incorporated in the car that our readers would like to know of. What we are particularly interested in are novel stunts, new devices, new kinks, and new hints made possible by the electric current.

In order to win a prize the first requisite is that the device or suggestion be practical. The term **PRACTICAL** will be the keynote of this contest.

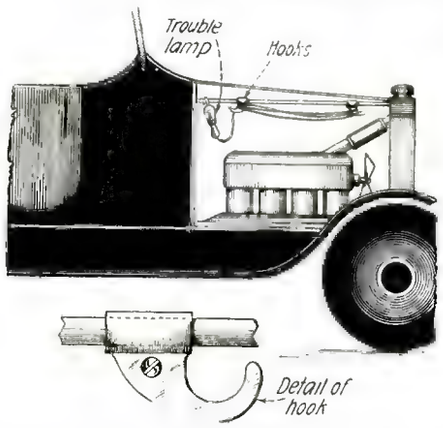
You will be more apt to win a prize if you will design the device yourself, and make a photograph of it, sending the same to us. Ideas are all right, but the reader wants to see that the device actually has been made, and WORKS.

The following prizes will be paid:

FIRST	PRIZE.....	$25.00
SECOND	PRIZE.....	15.00
THIRD	PRIZE.....	10.00

All other accepted articles which win no prizes will be paid for at the rate of $1.00. Each article submitted should not be longer than about one hundred to two hundred words.

Address all manuscripts to EDITOR "MOTOR HINTS," care of this publication.



A Trouble Light, Unless It Is Arranged So As to Be Instantly Available, Is More of a Nuisance Than An Asset—Mr. Benson Here Suggests a Very Good Idea for Carrying the Trouble Light and Its Long Flexible Cord on Two Hooks Secured to the Brace Rod Between the Radiator and the Cowl.

CARRYING THE TROUBLE LIGHT

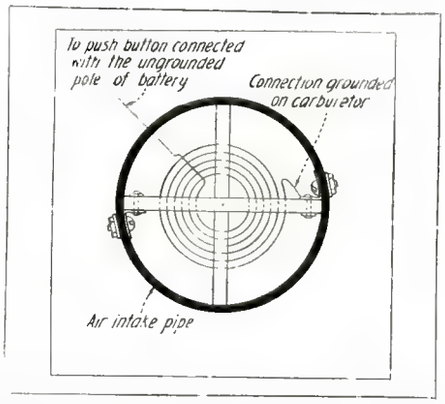
A trouble light becomes a source of annoyance when it must be untangled from the tools or dug out of a side pocket when the unexpected blow-out or engine trouble occurs. To eliminate this arrange two hooks on the radiator brace about one foot apart on which the cord can be easily wound. A hook soldered to the lamp guard will allow it to be hung either on the hooks or the cord. Connect the lamp permanently to the battery and put a switch on the back of the dash.

The lamp is then always ready for instant use, to read the gas gauge on the tank in the rear, by simply unwinding; snap it on for engine trouble, or it is accessible for tire trouble. With this arrangement the lamp becomes a real help and will be used much oftener when it is so convenient.

Contributed by THOMAS W. BENSON.

THIRD PRIZE $10.00
ELECTRIC AIR INTAKE WARMER

This device is fastened inside the carburetor air intake pipe, and when a current is passed through it, it immediately warms the



No Matter How Many "Stoves" You Have Piped Up to Your Carburetor System, None of Them Will Help to Start a Cold Motor. Here is a Clever Scheme for Heating the Air Fed the Carburetor With an Electrical Resistance Coil.

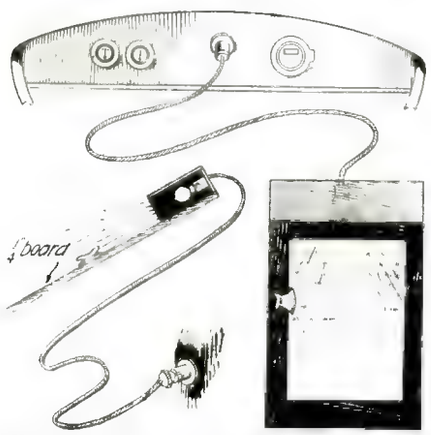
air sufficiently to enable the motor to be started easily. It consists of two cross-pieces of wall board (fibre, bakelite or asbestos board is best) cut about one half inch wide, and just long enough to fit inside the air intake pipe. These were mortised together, and after punching holes through them, I wound them with a few turns of some resistance wire taken from an old rheostat. Angle pieces were fitted inside the air intake pipe; I drilled holes through the pipe and bolted the device fast, bolting one end of the resistance wire securely at the same time so as to ground it. The other end was insulated, and after drilling another hole through the pipe, I led the wire through and connected it with a push button. It is important that the other wire to the push button be connected with the *ungrounded* pole of the battery. This device does not choke the pipe enough to amount to anything. By holding the push button in for about ten seconds, the air in the pipe is warm enough to start the motor.

Contributed by FRANCIS U. SLAGHT.

LIMOUSINE LIGHT

Owners of limousines and coupés, particularly business men who are going to and from their offices, in the late evening when the days are short, feel the necessity of having a light whereby they can

(*Continued on page 790*)



A Handy Reading Board Which Can Be Held in the Hand, and Which Is Provided With an Electric Lamp Supplied With Current from the Car Battery.

Practical Chemical Experiments

By Prof. FLOYD L. DARROW

QUALITATIVE ANALYSIS—EIGHTH AND FINAL PAPER

Converting the Sulphates of Barium and Strontium into Carbonates, by Fusing Them With Sodium and Potassium Carbonates on a Platinum Foil.

Testing for Sulphur. Fused Mass Has Been Placed on a Silver Coin and Is Being Moistened With Water. If Sulphur Is Present, a Brown Stain Will Appear on the Coin.

IN THE preceding article we had described the procedure to be followed in the preliminary examination of a solid substance through the heat treatment of it with concentrated sulphuric acid. We shall now take up the work at that point and, if possible, complete in this article the directions for the systematic analysis of unknown substances.

Heating on Charcoal.—A number of important indications may be had from heating the solid substance on charcoal with the flame of the blowpipe. The points to be noted are as follows.

If the substance melts and runs into the charcoal, alkali salts are present.

If a residue is left which will not melt and which gives an alkaline reaction, look for barium, strontium, calcium and magnesium.

If the residue when moistened with cobalt nitrate solution and reheated gives (a) blue, aluminum is present, (b) green, zinc, (c) delicate pink, magnesium.

If the substance deflagrates on the charcoal, chlorates or nitrates are present, possibly both.

If the substance forms an incrustation, note the following indications: (a) white with odor of garlic, arsenic; (b) white nearer the place of heating, antimony, (c) yellow when hot, white when cold, zinc; (d) light yellow when hot, white when cold and does not vaporize, tin; (e) deep yellow, both hot and cold, lead; globules of lead also appear; bismuth behaves similarly but metallic globules do not so easily appear; (f) reddish brown to orange, cadmium; (g) dark red, silver.

Heating on Charcoal with Sodium Carbonate.—Pulverize the substance, mix it with sodium carbonate, and heat with the blowpipe on charcoal. Some of the following important indications may be obtained.

If metallic globules are obtained without an incrustation, gold, silver or copper may be present.

If malleable globules of metal with an incrustation are formed, tin or lead is indicated. If the globules are brittle, antimony or bismuth should be looked for.

If particles which are attracted by a magnet are obtained, they are iron, cobalt, or nickel, probably iron.

If when heated in the oxidizing flame, a yellow residue is obtained chromium is probably present; if the residue is green, manganese is indicated.

If when heated in the reducing flame (the inner cone of the blowpipe flame), a mass is obtained which, when placed on a silver coin and moistened, leaves dark stains, sulphur compounds are present.

Flame Tests.—To make the flame test, as already described in this series of articles, dip a clean platinum wire into a solution of the salt to be tested and then place it in the oxidizing flame of the Bunsen burner. Do not put platinum in the reducing flame. It will be injured if you do. After using the wire with one solution clean it by dipping in concentrated hydrochloric acid and heating in the oxidizing flame until no coloration is given to the flame.

The following results may be obtained. A bright yellow flame shows the presence of sodium. A violet flame, either with the naked eye or when looked at through a cobalt blue glass, indicates potassium. A carmine red flame indicates lithium. A bright red flame is due to strontium. An orange flame is produced by calcium. A green flame shows barium or boric acid. A blue to green flame may be due to copper.

Borax Bead Tests.—Make a small loop on the end of a platinum wire. Heat it to redness in the flame and dip it immediately into a small heap of borax powder. The powder will cling to the loop and upon reheating in the flame will melt into a clear glassy bead. Then touch the hot bead *very lightly* to the substance to be tested and reheat in the oxidizing flame of the burner. You will observe that the substance being tested fuses with the borax and when cooled may give a characteristic color depending upon the substance. The borax is in this case what we call a flux. Do not attempt to dissolve a metal in the bead. Oxidize if possible, or it will spoil the platinum wire. Heating on charcoal in the oxidizing blowpipe flame will suffice in some cases.

The results to be looked for are as follows:

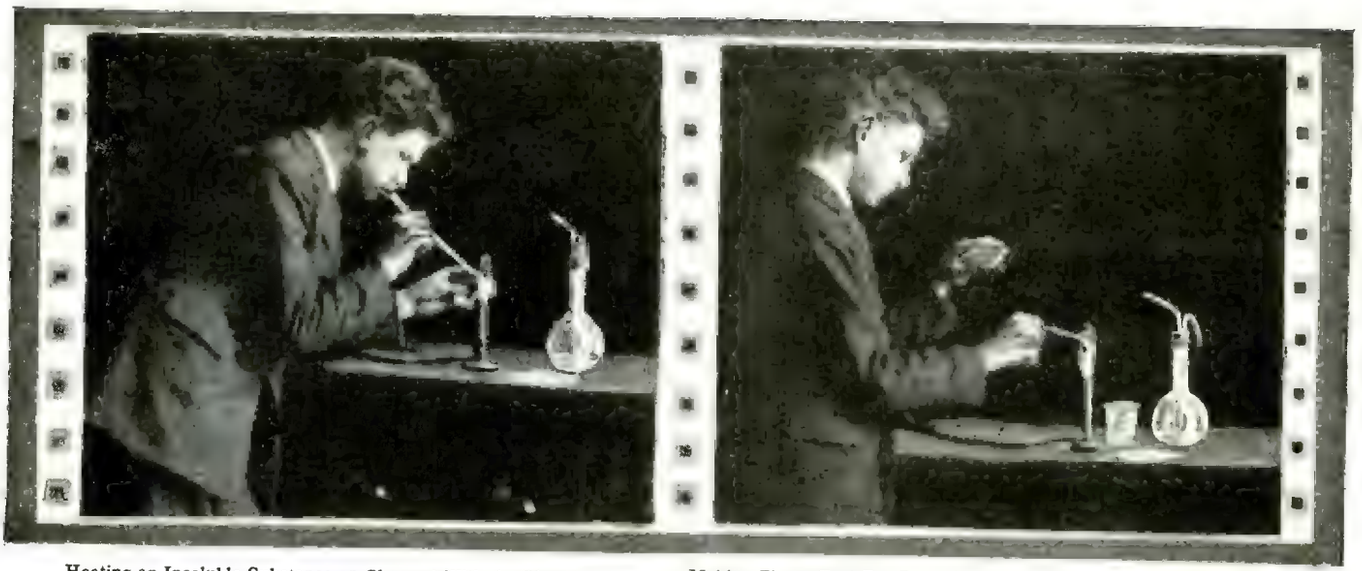
Blue both when hot and cold, cobalt.
Green when hot, blue when cold, copper.
Green both when hot and cold, chromium
Brownish red when hot, light yellow when cold, iron.
Violet when hot, reddish brown when cold, nickel.
Yellowish brown when hot, light yellow when cold, bismuth.
Violet red when hot, wine red when cold, manganese

Subsequent Treatment.—If the substance is neither a metal nor an alloy boil a pinch of it in a test tube with 10 cc. of water. The substance may dissolve giving a neutral or acid reaction. If so, proceed at once with the general analysis of the metals beginning with Group I. In analyzing for the metals always add the group reagent to a small portion of the solution. Then if no precipitate forms, you may proceed with the next group. In beginning Group II, remember that the solution must be made acid with dilute hydrochloric acid before passing the hydrogen sulphide. This is to prevent the possibility of precipitating as sulphides any of the metals beyond that group.

If the substance only partly dissolves in boiling water, filter and wash the residue in hot water, adding filtrate to the washings. Analyze the mixture for the metals the same as though the substance had been completely soluble. In both cases when the analysis of the metals is complete, using a fresh portion of the substance, analyze for the acids according to the directions already given.

The Insoluble Residue.—To the residue insoluble in water add a few cc. of dilute hydrochloric acid and boil. If it is still insoluble, pour off the liquid and try concentrated hydrochloric acid. If it dissolves add the two solutions, the one with dilute and the one with concentrated acid, and proceed with Group II of the metals. It is obvious that if the substance dissolves in hydrochloric acid, the metals of Group I will be absent. During the solution in hydrochloric acid important indications as to the nature of the substance may be had from the gases that are given off.

If the substance does not dissolve in hydrochloric acid boil it with nitric acid. If the substance dissolves begin the analysis of the metals, starting this time with Group I. Since nitric acid is an oxidizing agent and hydrogen sulphide a reducing agent, it is more difficult to precipitate the metals of Group II from a nitric acid solution than it is from one in hydrochloric



Heating an Insoluble Substance on Charcoal With the Blowpipe.

Making Flame Test For Potassium, and Looking Through Cobalt Blue Glass to Cut Off the Yellow Sodium Rays.

acid. The gas must be passed for a longer time as the nitric acid will decompose it at first.

If the substance will dissolve in neither hydrochloric nor nitric acids boil it with aqua regia. If it dissolves begin with the procedure for Group I of the metals, after boiling until free chlorine is all expelled.

In work which you will be called upon to do, if there are substances which resist the action of the solvents just named, fusion with sodium carbonate may generally be resorted to.

The procedure to be used with metals and alloys has been given in a previous article.

Examination of Solutions.—First evaporate a small portion and if a residue is obtained submit it to the preliminary tests described in this and the previous article.

Then test the solution with blue and red litmus paper. If it is acid proceed with the regular analysis of the metals, following it with the tests for the acids, remembering that for the acids a fresh portion of the solution must be used.

Alkaline Solutions.—The analysis in such cases is considerably complicated. The general procedure is as follows. Neutralize the solution with hydrochloric acid. This may precipitate a large number of compounds, compounds that had been held in solution by the alkali. Filter off any precipitate and test the filtrate for the metals beginning with Group II. Try to dissolve

(*Continued on page* 803)

Ether and Its Laboratory Preparation

By JOHN J. HALKO, A.B.

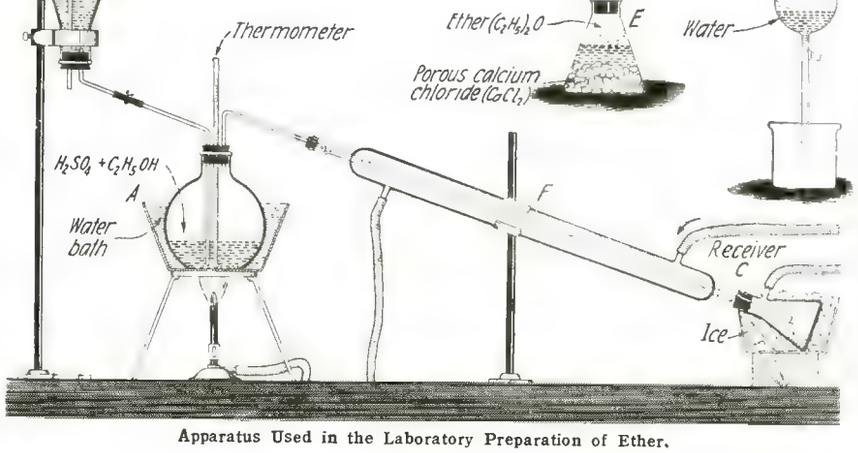
THE discovery of ether is attributed to Valerius Cordus in 1544. It was obtained by distilling pure spirits of wine with strong sulphuric acid. Today ether is made on a large scale by mixing sulphuric acid and alcohol in certain proportions, and then distilling the mixture with more alcohol. Ether is also commonly known as *sulphuric ether*, the latter name being originally given to it because sulphuric acid is used in its manufacture, not because any sulphur is contained in it.

Ether is very volatile and an exceedingly inflammable liquid. It should be kept away from a free flame. It is composed of carbon, hydrogen and oxygen. When inhaled, it produces unconsciousness, and is used today very extensively in this capacity in America. When ether is brought upon the skin in the form of a spray, the cold produced by the rapid evaporation and its freezing effect upon the tissues is so great as to cause insensibility to pain and other impulses. It has been established that there is an average of only one death in almost 30,000 cases, due directly to its use. Chloroform, also an anesthetic, is much more disastrous; about one out of every 3,000 cases proving fatal.

This volatile liquid is somewhat soluble in water, and is also somewhat, though less, soluble in ether; so that when the two are shaken together, the volume of the ether becomes smaller, even though every precaution is taken to avoid evaporation. Ether mixes with alcohol in all proportions. It is a good solvent for resins, fats, alkaloids.

Laboratory Preparation.—Provide a flask with a stopper, which latter has three openings. Through one of these openings insert a thermometer, pushing it in far enough to reach within a fraction of an inch of the bottom of the flask; through a second opening pass a bent tube to connect the flask (A) with a condenser; through the third opening, introduce the dropping tube, also long enough to reach nearly to the bottom of the flask. Connect the flask with a condenser, which dips into a receiver (C), surrounded by ice-cold water.

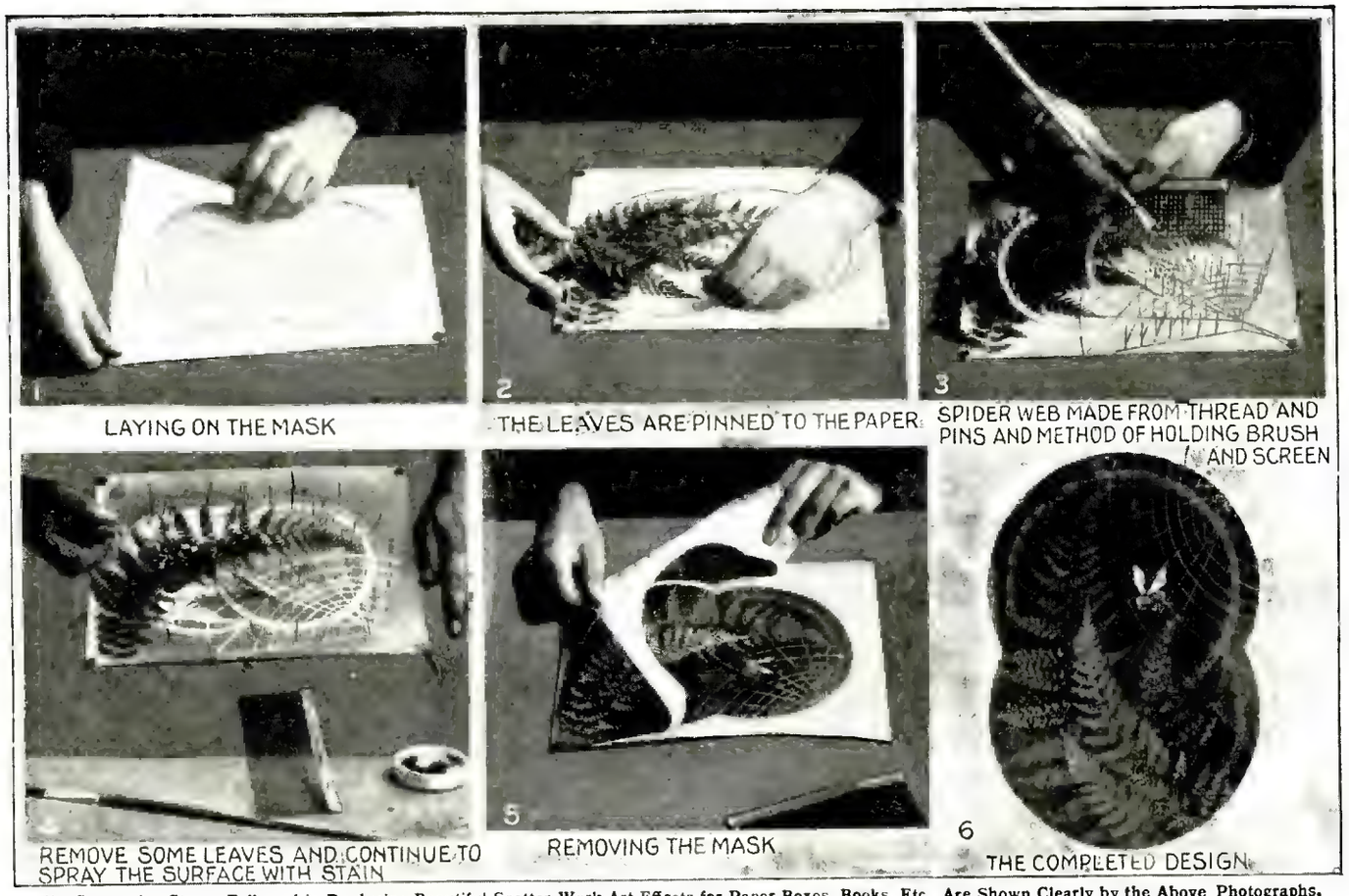
Put into the flask A a mixture of 150 c.c. of absolute alcohol and 150 c.c. of pure, concentrated sulphuric acid, and heat the flask over a water bath until the thermometer indicates a temperature of 140° C. (284° F.). During the entire operation, the temperature must be maintained between 140° C. (284° F.) and 145° C. (293° F.). When the temperature has reached this point, and is practically constant, let 100 c.c. of alcohol flow from the flask B, regulating the amount by means of a pinchcock, so that the liquid flows a drop at a time. Continue the heating for a few minutes after all the alcohol has been added. When this operation is finished, remove the stopper of the flask. Place the distillate from the receiver C in a separatory funnel, and wash it three times with successively smaller portions of a strong solution of sodium chloride to which a little sodium hydroxide has been added. This is to prevent the ether from dissolving. Finally, shake it several times with small quantities of ice-cold water. The purified ether should be separated each time by means of a separatory funnel (D), and finally dried over porous calcium chloride in a flask (E), for a period of twenty-four hours, and then distilled. When distilling use only the flask (A), condenser (F), receiver (C) and a thermometer. Ether boils at 34.9° C. (94.8° F.).



Apparatus Used in the Laboratory Preparation of Ether.

Spatter Work—How It Is Made

By Dr. ERNEST BADE


1
LAYING ON THE MASK
2
THE LEAVES ARE PINNED TO THE PAPER
3
SPIDER WEB MADE FROM THREAD AND PINS AND METHOD OF HOLDING BRUSH AND SCREEN
4
REMOVE SOME LEAVES AND CONTINUE TO SPRAY THE SURFACE WITH STAIN
5
REMOVING THE MASK
6
THE COMPLETED DESIGN

The Successive Stages Followed in Producing Beautiful Spatter Work Art Effects for Paper Boxes, Books, Etc., Are Shown Clearly by the Above Photographs, Figs. 1 to 6

SPATTER work is a curious and decorative art which does not demand an artistic temperament. Good judgment and common sense is all that is necessary for its successful mastery, and many an interesting and useful article can be made with its aid.

Spatter work is just as effective on paper as on cloth, although any medium may be used with equal success. Small boxes decorated with leaves and butterflies are exceptionally beautiful and wonderful effects are produced with trays, napkins, centerpieces, etc., if two or more colored inks are used.

The materials necessary are so limited that it almost seems an impossibility that such exceptional results can be gotten from such simple devices. Only two essentials are required, and these are found in all homes. The first is a good stout bristle brush, not too large, one a quarter of an inch wide will answer the purpose in every respect, and the second is a small piece of wire mesh three inches wide and about six inches long. The mesh should be 1/8 to 3/16 inch, the latter being the more suitable degree of fineness. Besides this, ink is necessary, indelible ink being the best, and if various tints are used, the results will be more pleasing than if just one shade is used throughout.

The most common objects which are used for this work consist of leaves, paper clips,

An Artistic Spatter Work Design Made by the Aid of Leaves and a Moth or Other Insect.

paper designs, cord, and pins, although other objects will suggest themselves after this process has once been tried.

If leaves are to be used, they must first be dried and pressed. This is accomplished by placing each leaf between a number of sheets of newspaper. Over the whole a piece of stiff cardboard is placed which is surmounted by a number of heavy books, three or four being sufficient. After about an hour the papers are changed and the leaves again pressed. This accelerates the process of drying.

Dried leaves keep indefinitely, and they can be used at any time. When about to use them they are pinned on the paper after the mask which consists of a piece of stiff paper so cut that it covers the edges of the drawing paper, has been attached. The leaves should be feathered and fernlike, or deeply lobed and notched as the pin oak or silver maple. If desired a butterfly or bee can be added to the design as this heightens the effect, especially if they are accurately cut.

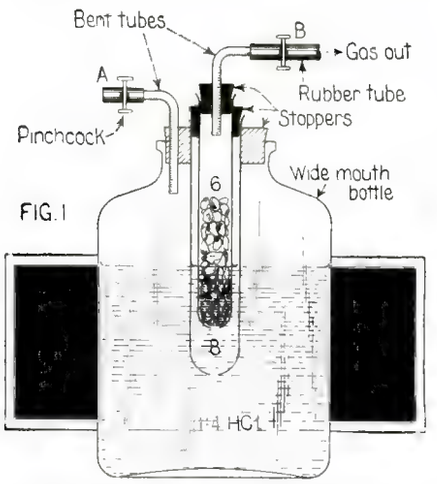
An additional or part mask can be added if desired, which is also pinned to the paper. A spider web is a very effective decoration,

(*Continued on page* 805)

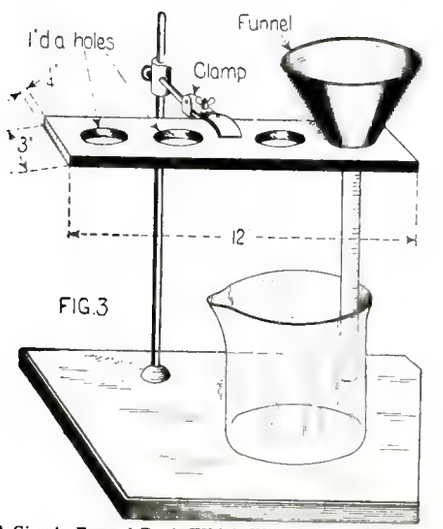
Simple Chemical Laboratory Adjuncts

By RAYMOND B. WAILES

A GAS generator which will, at a moment's notice, produce any gas desired is not to be found in many laboratories. How simple an apparatus of this sort really is can be seen by an inspection of Fig. 1.



Interchangeable Automatic Gas Generator. Several Tubes (No. 6) Are Filled With the Desired Substance and Inserted Into the Larger Tube (No. 8) as Desired, Thereby Generating Any Gas Desired and at a Moment's Notice.



A Simple Funnel Rack Which Will Be Found Useful in Any Chemical Laboratory.

Here, 6 is a 6-inch test tube, and 8 is an 8-inch tube; small holes are blown through their ends, using a pointed flame from a blowpipe. They are affixed to each other by a rubber stopper as shown, and are inserted into a bottle containing 1 part commercial hydrochloric acid to 4 parts of water.

The inner tube, 6, of which size a number of tubes can be prepared, contains the desired chemical which will react with the acid to produce the gas required. To switch over from one kind of gas to another, remove the inner tube 6 and replace with another tube containing the desired reactive substance.

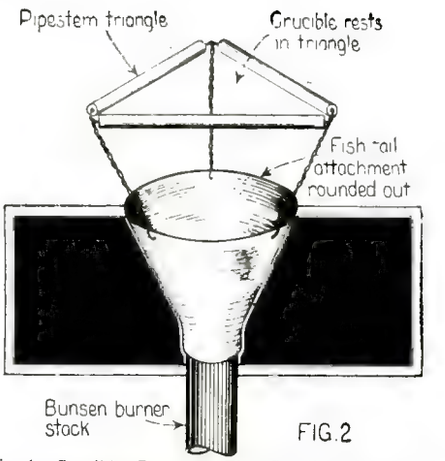
To operate: Open valves or pinchcocks A and B. Acid will rise into 8 and 6 and react with substance in 6, producing gas which is taken off at B. On shutting B, pressure backs up acid from 6 and 8, preventing action. When A is shut tight, the acid is forced down from 8 and 6, and another "cartridge" of reagent in the form of a filled test tube can be inserted into 8 if desired.

A fish tail burner attachment bent out into a circle and supporting a pipe stem triangle as shown in Fig. 2 makes a wonderfully good crucible support for ignitions, alloying, etc. The crucible to be heated is placed in the triangle and the Bunsen burner lighted. The usual tripod or retort stand is dispensed with. The attachment can be lifted off the burner if desired.

Fig. 3 shows an easily constructed funnel rack or support. It is self-explanatory.

Using the apparatus shown in Fig. 4, the laboratory or shop can have air under pressure or a vacuum at will. Water enters the tee tube and sucks air in at the side tube, producing a foam which is driven into 3-necked Woulff bottle. The air from the foam passes out by the tube A, while the water flows out at B, the tube of which should be as large as the neck permits. The end of the tee tube is constricted by means of a one-hole cork.

In order to increase the air pressure in this particular device, the water supply at H_2O must be regulated, which should be done with an ordinary adjustable pinchcock. The waste water flowing from this apparatus should not be greater than the incoming water, and the tube B is preferably not long enough to produce siphoning action. Of course with an apparatus of this sort it is impossible to produce any great amount of pressure, although the air supply is fairly constant. With a good vacuum pump put in place of the glass contrivance the amount of air may be increased. By completely



Simple Crucible Support. The Crucible Rests in the Pipe Stem Triangle, Dispensing With a Tripod. The Whole Is Easily Removed.

pinching off the exhaust water pipe, B, for a few seconds, the air pressure rises due to the rise of the water level in the Woulff bottle. This increase is not very steady however. When the pressure reaches a certain point, the air backs up through the vacuum and air-producing device.

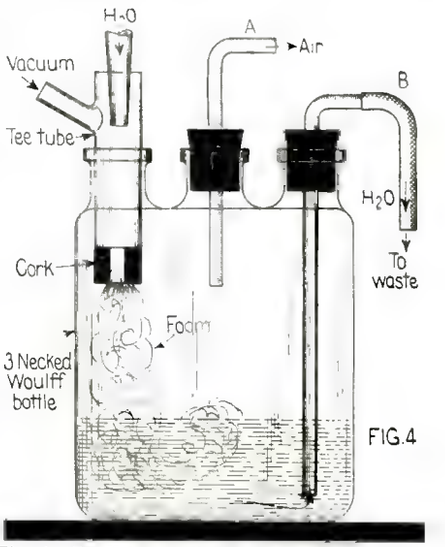


Fig. 4. By Using a Three-Necked Woulff Bottle, You Can Easily Obtain a Moderate Supply of Air Under Pressure and Suction.

Those Deadly Dynamite Caps

The appearance of a percussion cap used for detonating dynamite, and that of the ordinary .22 calibre special shell are so near alike that they are often confused. Both are copper finished, and about the same size and diameter, the only visible difference being that the cap possesses no rim.

The dynamite cap is so deadly in its effects and so easily set off that the above difference should be borne in mind. Only the other day we read of a slip of a lad, mistaking the one for the other, who accidentally discharged it in his pocket by rubbing the loaded end against a coin. The result was fatal, amputation of one leg being necessary. The victim failed to rally from the great loss of blood.

The two photos show what one of these caps will do. Piqued with curiosity, the writer prepared a short length of fuse with the cap on one end, and set it off in a short length of one-half inch pipe. The pipe was

The Pipe and Cap With Fuse Before Discharging.

What the Little Dynamite Cap, Smaller in Diameter Than a Pencil, and Only One Inch Long, Did to the Pipe.

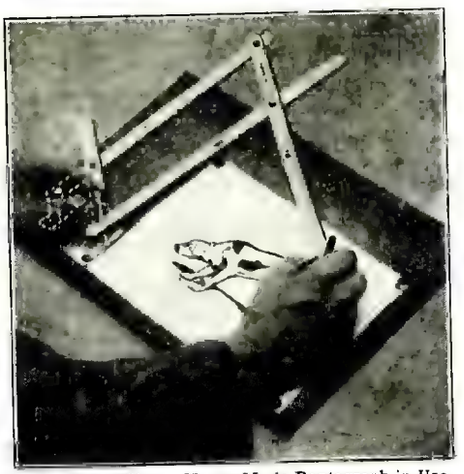
left open at both ends, yet the rupture clearly shows the split extending along the pipe for almost four inches. Upon examination it was found that the inside surface of the pipe was pitted by tiny pieces of copper.

It stands to reason that these dynamite caps, if kept in the pocket which contains loose change, could explode by the friction produced by the coins, particularly if the hand is thrust hastily in the pocket in an effort to extract some change. An explosion at this time could undoubtedly drive pieces of silver and nickel coins into the leg, and sever the hand, perhaps so severely injuring the individual that he might recover with difficulty only. Remember, therefore, not to keep any cartridges without rims which appear to be of the .22 calibre type in the pocket. Also bear in mind that these dynamite caps are deadly, and that you may mistake one of them for a rimless cartridge.

Contributed by DALE R. VAN HORN.

How To Make An Accurate Pantograph

A PANTOGRAPH is a mechanical device employed for the enlarging or reduction of pictures in correct proportions. It was the mathematician, C. Scheiner, who invented it in 1650, and to-day this instrument is used for drawing maps, plans, etc. In its simplest form it consists of four thin strips of wood of any convenient length, three of which are equal in length and the other about ½ to one inch more than half their length.



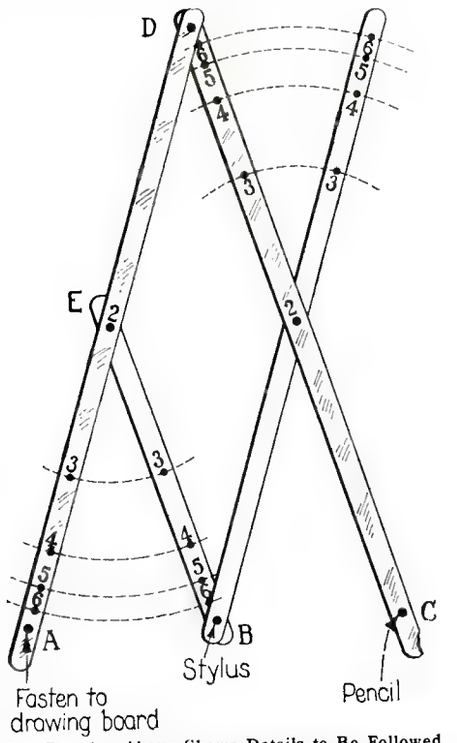
This Picture Shows Home-Made Pantograph in Use, the Fingers of the Left Hand Being Used to Guide One Stylus Over the Smaller Picture of the Dog, While the Pencil Forming the Second Stylus Traces the Outlines of the Larger Picture of the Dog. Pictures May Be Reduced or Enlarged in This Way.

A convenient size for the longer sticks is 18 inches, all of them being about ½-inch wide and ⅛-inch thick. Holes are bored at the ends of the longer sticks in such a way that they are equally distant from each other. Then two holes are bored in the smaller one which are exactly half the distance apart of those in the larger sticks. At the same distance from the end holes a third hole is bored in each of the three longer ones.

Connect one long stick to the short one by means of a short bolt at B. Take another long stick and connect also to the short stick at E. To the center of the longer stick B attach DC and connect the end D to DA. Then D2B2 is a parallelogram and if end A is firmly attached to the drawing board, end B receives a stylus and C a pencil; a picture placed at B can be drawn at C which will be just twice the linear dimensions of the original. If the pencil at C is interchanged with the stylus at B and the drawing then placed at C, the original will be reduced to one-half its size when carefully drawn at B. Of course, all connections should be free, yet without shake.

If greater magnifications or reductions are desired, other holes must be added as shown at 3, 4, 5 and 6, which correspond to the diameter enlarged or reduced. For this purpose take a compass and open it to any convenient degree—it makes no difference where it is placed—and hold at the holes in 2 and draw a circle 33 and 33. This represents three diameters. Then carefully and exactly divide the distance 23 in half and draw another circle to 4 from each 3, or add this half-distance to the original distance and draw from 2; both amount to the same thing. Again divide this distance 34 in half and draw another circle, etc., until the desired number of reductions and magnifications are obtained. Then, too, the distance between 2 and 3 can be subdivided into halves, quarters, and eighths in the same way. Dividing distance 23 in half gives 2½ magnifications, dividing each half again gives 2¼ and 2¾ respectively, and so on.

For the purpose of drawing these magnifications or reductions, holes are bored at these places and the bolts moved to the corresponding numbers desired. For instance, the rod is moved so that the two 3's on EB and EA coincide and the bolt is passed through these two holes. The same is done on the other upper hand provided with these holes. It must always be remembered that a perfect parallelogram is formed with all magnifications, and in size it narrows with an increase in enlarging or reduction, as the case may be.



The Drawing Above Shows Details to Be Followed in Building the Home-Made Pantograph Here Described

Auxanometer Measures Electrified Plant Growth

By WALTER E. BURTON

STUDENTS of botany, especially, will find it interesting to measure the growth of plants under various conditions. For this purpose an *auxanometer*, similar to the one shown in the illustration, may be used.

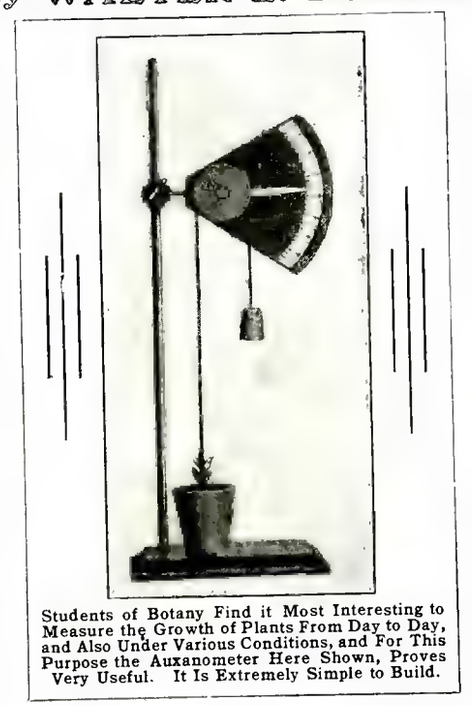
The grooved wheel has a pointer affixed so that the movements of the wheel are indicated upon a scale.

A silk thread is passed over the wheel, one end of the thread being fastened to the tip of the plant to be measured. A weight is attached to the other end of the thread. This weight is of sufficient size to keep the thread taut enough so that the movements of the thread, caused by the growing plant, are transferred to the wheel. An ordinary bottle cork makes a good weight.

The wheel is turned from wood, and is ⅛ inch thick, and 2 inches in diameter. The pointer is made of sheet aluminum, and is 2 inches long.

The wheel and pointer are mounted upon a fan-shaped wooden base in such a manner that the end of the pointer moves through an arc across the large end of the fan. The wheel must move freely upon its bearings. It may be balanced by placing a weight near the edge opposite the pointer.

The above dimensions produce an instrument in which the growth of the plant is magnified three times. That is, the distance from the center of the wheel to the tip of the pointer is three times the distance from the center of the wheel to the thread at the circumference, which gives a 3 to 1 ratio.



Students of Botany Find it Most Interesting to Measure the Growth of Plants From Day to Day, and Also Under Various Conditions, and For This Purpose the Auxanometer Here Shown, Proves Very Useful. It Is Extremely Simple to Build.

The instrument is supported on a standard, such as a ring-stand. The thread is attached to the tip of the plant, and the pointer is set at zero.

With such an instrument as that described experiments were conducted to note the effect of electricity upon a corn plant. A young plant about 4 inches high was used.

The plant was placed in a north window. The experiments were conducted during the month of April. The normal growth was 3/32 inch in 24 hours.

One dry cell was first used, having a voltage of 1.188, and an amperage of 2.97. The positive pole was connected to a nail driven in the earth near the roots. The negative pole was connected to the tip of the plant by a No. 40 copper wire. The growth during 24 hours of application was 1¼ inches. The poles were reversed and the growth was ¾ inch. during 24 hours.

Next, three dry cells were used in series, the voltage being 5.64, and the amperage 1.76. The positive pole was attached to the nail, and the negative pole to the tip of the plant. The growth was ½ inch during 24 hours.

Under the influence of a Daniel cell, giving 1.836 amperes at 1.08 volts, the growth was 7/32 inch in 24 hours, the positive pole being at the bottom, and the negative at the top.

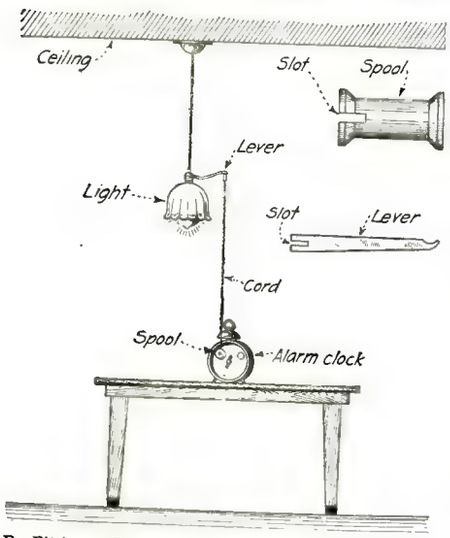
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First prize, $15.00; second prize, $10.00; third prize, $5.00.
The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of $15.00 is awarded; for the second best idea a $10.00 prize, and for the third best a prize of $5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, $15.00
POSITIVE SLEEP INTERRUPTER

For those who find it difficult to get up in the morning, as well as for those who must get up during all hours of the night, the following described alarm clock will be found very efficient, in operation not only awakening the sleeper, but turning on a lamp, placed over the slumberer's head.

Everyone knows it is difficult to sleep with a light in the room turned directly toward the resting individual. A spool is first procured and slotted to fit the alarm key tightly. A string is now tied to the spool, and the other end of the string is fastened to the ring. A pull chain lamp socket is equipped with a wire extension lever, and the eyelet or ring on the end of the cord is slipped over this lever, as illustrated. On subsequent occasions I have used the regular key socket, making an extension lever out of wood or brass, which lever is also



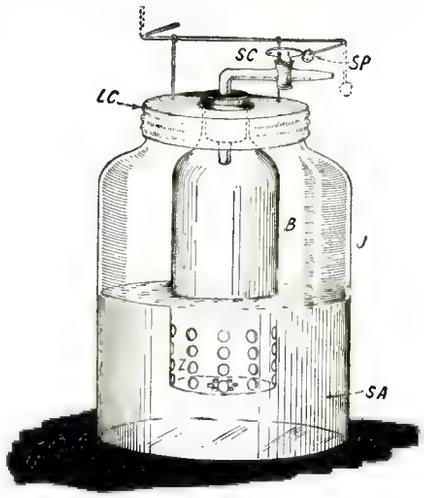
By Fitting a Spool to the Alarm Winding Key of an Alarm Clock, It Becomes a Simple Matter to Switch on an Electric Light, the Socket of Which Is Provided With an Extension Lever of a Well-Known Type, Available in Electric Supply Stores.

depicted in the diagram. It is evident that as the alarm clock rings, the cord is wound up on the spool, and the light turned on at the same time. It will also be seen that when the lever reaches the end of its descent, the ring will slide off the end of the lever, permitting the alarm clock to continue ringing.

Contributed by DILLARD S. WRIGHT.

SECOND PRIZE, $10.00
CHEMIST'S SELF IGNITING LAMP

To make this lamp, procure a one quart preserving jar and a bottle that will fit inside of the jar, but which will not quite reach the bottom. Cut a hole in the cover of the jar and fit the bottle B, in it. Then drill a hole about one-quarter of an inch diameter, in the bottom of the bottle. Now obtain a rubber stopper with a hole for a glass tube and fit into the bottle. The delivery tube drawn narrow at one end should be provided with a stop cock. By soldering two wires with loops on the ends of each, as shown in the drawing, to the top of the jar, and then passing a wire bent at right angles through these loops at the end of which a piece of sponge platinum is fixed, we have completed the installation.



A Self-Contained Lamp Which Generates Its Own Gas, and Is Also Provided With a Self Igniter Composed of a Small Piece of Platinum Sponge.

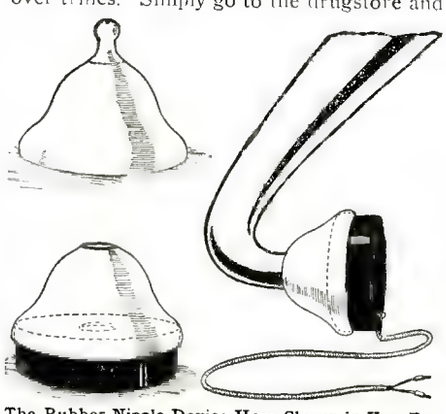
The jar is now filled with dilute sulphuric acid and lumps of zinc are placed in the inner bottle. The gas will begin to generate immediately. It is then permitted to flow out of the nozzle for a few moments, to expel the air, and then the sponge platinum may be brought into play. I have found that instead of using a bottle, an ordinary Argand lamp chimney may be employed, a piece of fine copper screening being placed at the stricture in the neck of the lamp chimney to prevent the lumps of zinc from falling out of the chimney to the bottom of the jar. The cap of the jar is preferably punctured with holes or loosely fitted to permit the access of air.

Contributed by ALBERT ANDERSON.

THIRD PRIZE, $5.00
LOUD-TALKING ADAPTER FOR PHONOGRAPHS

If you have no baby about, why worry over trifles. Simply go to the drugstore and procure a hygeia nipple. The top of this nipple is cut off, the base of it placed around the receiver cap, and the tip slipped over the phonograph tone arm. Connect it to your receiving set and—presto—you have a most suitable attachment. The nipples being of rubber, will fit almost any size of phone, and the connections are all tight. If you have no phonograph, simply substitute a tin or paper horn. I have found this to be as efficient as a high priced adapter.

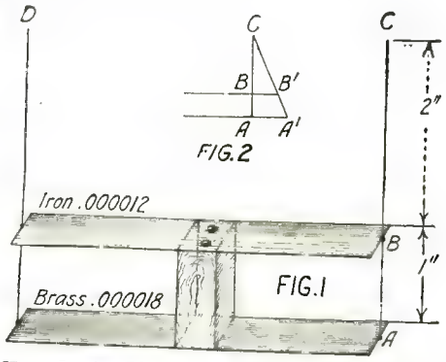
Contributed by H. K. MAYFIELD.



The Rubber Nipple Device Here Shown in Use, For Adapting Your Radio Receiver to the Phonograph, Can Be Purchased at Any Drug Store. The Large Base at the Nipple Is Fitted Over the Receiver Cap, While the Tip Is Slipped Over the Phonograph Tone Arm.

A COMPENSATED MEASURING BAR

It is a well-known fact that almost every substance expands when heated and contracts when cooled. Many times it is necessary to take into account this expansion and contraction attending changes of temperature. Long steam pipes are fitted with expansion joints, and in long steel bridges built in cold climates certain freedom of motion of the



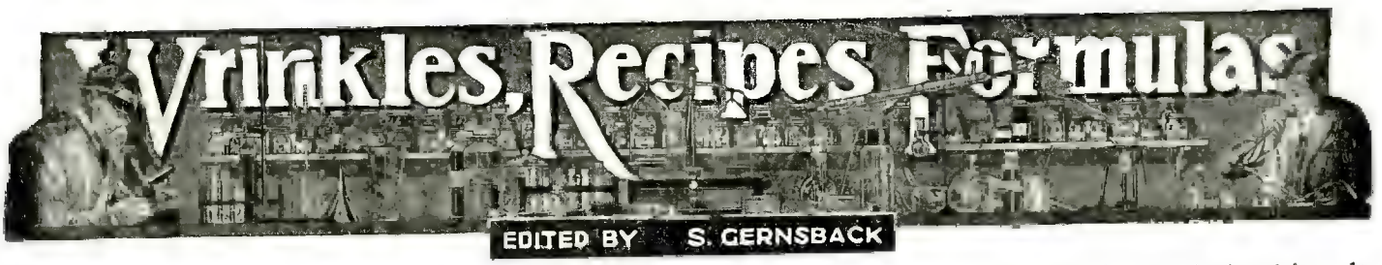
Here Is An Idea For Making a Compensated Measuring Bar, Which Will Always Read the Same Length, Irrespective of Temperature Changes.

parts must be provided for. The length of a clock's pendulum varies with the temperature and accurate timepieces have compensated pendulums. A measuring bar would not be absolutely correct unless graduated and used at a given temperature.

It may be of scientific interest to know how a bar might be constructed that has a length that remains the same regardless of the temperature. The fact that the coefficient of expansion of many metals is pretty well known will admit of the construction of such a bar. Two bars of equal length, one of iron and one of brass, are joined together as shown in the illustration. The distance AB is one inch and the distance BC is two inches. Then the distance CD is the same without regard to the temperature.

For if the arrangement is heated 10 degrees Centigrade the brass rod will increase in length .000018×10× its length, and the iron rod .000012×10× its length. The increase in length of the brass rod is one-third more than the increase in length of the iron rod, but this is compensated by the distances AB and AC. This can easily be solved by means of similar triangles formed at each end of the rods. (Fig. 2.) It will be noticed that the length of the two rods is immaterial, but when constructed the distance CD remains the same with temperature variations.

Contributed by F. C. HENDERSHOT.



THIS MONTH'S $5.00 PRIZE

SIMPLIFIED ORGANIC CHEMISTRY

SOME of the more interesting products of organic chemistry, outside of medicines, are dyes, explosives, artificial essences and perfumes.

Many compounds, dyes, medicines and explosives are derived from aniline. At the drug store, get about an ounce of mono-nitro-benzene (masquerading under the names of "Oil of Myrbane" or "Artificial Oil of Bitter Almonds"). Prepare the aniline as follows:

In about a 200 c.c. flask, put 17 gm. of granulated tin and 77 c. c. hydrochloric acid (sp. gr. about 1.18). Add *slowly* (drop by drop if necessary) 10 gm. nitro benzene. When the action is over, add enough water to dissolve the contents of the flask, and add sodium hydroxide till the precipitate first formed is nearly dissolved. Distil, when aniline and water will pass over, and the aniline collect at the bottom of the receptacle, whence it may be taken with a medicine dropper.

To an aqueous solution of aniline in a test tube, add a filtered solution of calcium hypochlorite (chloride of lime). A beautiful violet color will be produced.

Make a solution of aniline in concentrated sulphuric acid, and add a crystal of potassium bi-chromate. A fine blue color will be produced.

Put some dry mercuric chloride and a few drops of aniline in a dry test tube and heat over a small flame. Dissolve the product in alcohol (denature with mercuric chloride, purchasable at most drug stores), and add a little hydrochloric acid. The beautiful color is due to rosaniline hydrochloride.

In a test tube, mix a *little* chloroform, alcoholic solution of potassium hydroxide and aniline. The intolerable odor soon produced is that of phenyl-iso-cyanate.

In a test tube, mix 1 part phenol crystals, 2 parts oxalic acid and 5 parts concentrated sulphuric acid. Boil for about 5 minutes and pour the red solution into cold water. *Aurin*, a yellow dye, is precipitated as a paste, insoluble in water.

In a test tube, mix 1 part nitro-benzene, ½ part iron filings and 5 parts concentrated hydrochloric acid. Boil for about 10 or 15 minutes, and then pour into cold water. *Erythrobenzene*, a red coloring matter, is precipitated.

Nigrosine may be prepared by dissolving aniline in alcohol, adding sulphuric acid, collecting the paste of aniline sulphate, and heating it with nitro-benzene.

Another important and extremely beautiful dye is fluorescein. To prepare:

Mix and powder 4 gm. naphthalene (moth balls). and 8 gm. potassium chlorate. Add *slowly* to 38 c.c. hydrochloric acid, sp. gr. about 1.18. Operate outdoors on account of chlorine gas. Naphthalene tetrachloride is formed and sinks to bottom of container as crystals. Wash with water, and add slowly to 35 c.c. nitric acid, sp. gr. about 1.42, and boil in a retort with neck upright. When crystals are dissolved, evaporate the acid and distil the residue, when phthalic anhydride passes over. Recrystallize from water, and add 5 parts to 7 parts resorcinol. Heat in a test tube to about 200° C. (till the mass fuses and boils), then cool. Fluorescein is formed. Try dissolving in a solution of potassium or sodium hydroxide. Notice, while different, that the two solutions show a wonderful fluorescence, one color by reflected light; another by transmitted light.

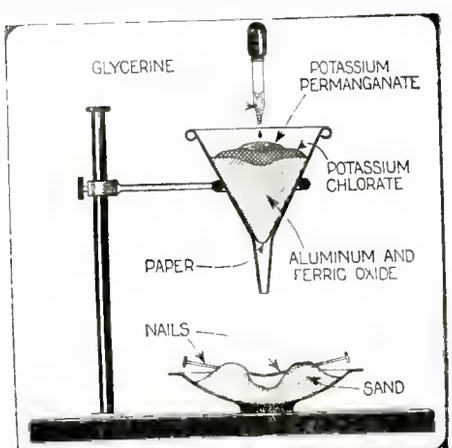
Put about 1/10th grain of the fluorescein in a test tube and add about 2 drops of bromide (prepared according to any standard text book). When the reaction is over, drive off the bromide, if in excess, by a gentle heat. Put about a teaspoon of water in the test tube and boil, adding potassium carbonate from time to time until the superb tint is properly intensified. The exquisite color and the wonderful fluorescence are due to the potassium salt of eosin (tetra-brom-fluor-escein), which is used as a dye. Try using the solution as ink, after adding a little gum arabic. Dilute a few drops to a test tube of water and notice the delicate pink of the early dawn.

Get about a gram of sulphonal at the drug store. Heat a small quantity with an equal amount of powdered charcoal. The *extremely* disagreeable odor is due to the presence of ethyl mercaptan or sulphur alcohol.

Contributed by J. EDWARD ARMSTRONG.

FORMULA FOR THERMIT

Amateur chemists are frequently handicapped by the lack of sufficient chemicals and apparatus with which to perform certain experiments which are not only interesting but instructive as well, and as many chemicals are of a hazardous nature, their



The Experiment Here Reproduced is a Method of Igniting Thermit Without the Use of Magnesium Ribbon. It is Equally as Safe, and Windy Weather Will Not Deter Its Action.

absence in the laboratory of the amateur is not at all surprising. The thermit experiment, for example, is one which gives a vivid impression of the process of thermit-welding, but, from personal interviews with amateur chemists, one finds that although this is one of the experiments which all are anxious to see. they are kept from it by the lack of magnesium ribbon with which to ignite the mass.

Here is a way to ignite the mass without magnesium. First procure a tin funnel having a diameter of about three inches. Of course, if you have a crucible which is meant for this purpose, it is much better, as undoubtedly the funnel will be ruined by the terrific heat generated. Then in the bottom place a paper, (folded in a manner similar to a filter paper). Fill the funnel approximately two-thirds full of a mixture of aluminum and black ferric oxide, mixed in the proportion of one part of the oxide to two parts of aluminum, (flake aluminum which may be obtained at almost any hardware store is excellent). Now support the funnel upon a ringstand or a tripod and in a depression made in the mixture add a spoonful or two of potassium chlorate, on top of this add one-fourth as much powdered potassium permanganate. Great care must be exerted in powdering this chemical. Under the funnel place a dish containing moistened sand in which two steel nails have been placed as shown in the sketch. Drop two or three drops of glycerine upon the potassium permanganate so that it remains in contact with it, then *stand back*.

At first nothing seems to happen, then the mixture begins to smoke and bubble, suddenly the mass takes fire and burns with a dazzling flame and when the action has subdued the nails will be found welded together. The heat is over 3,000° F.

The action between the aluminum (Al) and ferric oxide (Fe_2O_3) is $2Al+Fe_2O_3=2Al_2O_3+2Fe$. The ignition of the potassium chlorate is not necessarily done by the action of the glycerine upon potassium permanganate. This makes the experiment more interesting, however.

It is much safer to perform this experiment out of doors than in the laboratory or house. If done in the laboratory, space should be cleared and a marble or stone slab should be placed beneath the apparatus. Try it on a small scale first.

Contributed by S. B. SEELEY

THE CHEMISTRY OF STAINS

A chemical or physical combination of some substance with a suitable medium is usually the cause of a stain. If the combination is a chemical one and certain oxides are formed, one must reduce, dissolve or bleach the oxide to properly remove the stain. If the stain has been due to a physical cause, then the stain must be removed either by absorption or by solution.

At the end of an outing we hear the same old story that John has a grass stain on his new white flannel trousers, Mary's pink dress has been stained a beautiful deep purple in one spot by an overturned jar of jam, father's Palm Beach suit is soiled with grease spots trying to fix the engine which usually gets out of commission on this day, and mother has spilled iodine over her waist while putting some on a cut finger.

Below are given some methods for the removal of unsightly stains which will give good results if they are correctly applied.

Acid. With a medicine dropper ammonia should be applied to the stain taking care not to rub the stain. If it be colored or delicately colored fabrics the ammonia should be applied very gently. If the color is affected, chloroform may restore it.

Alkali. Sometimes stains are caused by lime, washing soda, etc. The spot should be moistened with lemon juice or vinegar. If the color is affected it may sometimes be restored by the use of chloroform.

Blood. A paste should be made of warm water and starch and applied to the stain allowing it to thoroughly dry and then gently brushing it away.

Dye. The stain should first be thoroughly wet with a 20 per cent. solution of acetic acid. The superfluous liquid is then absorbed by means of a blotter and a 3 per cent. solution of chloride of lime applied. Ammonia may also be advantageously used.

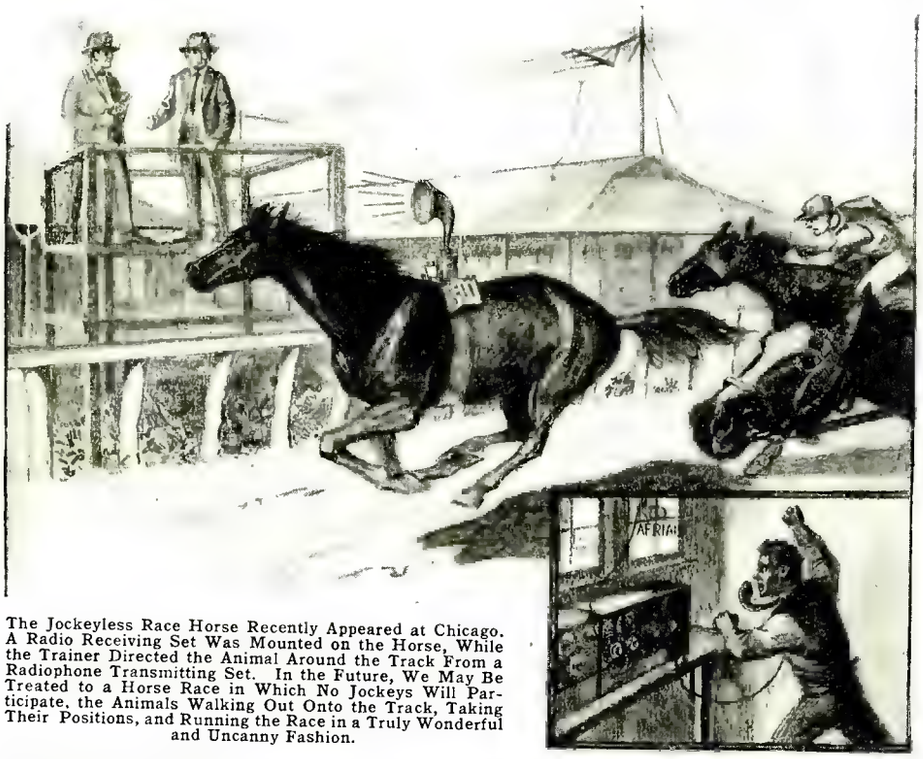
Fruit. These stains are best removed while they are fresh and to do so the cloth should be stretched over a bowl and the

(Continued on page 796)

RADIO DEPARTMENT

Horse Racing by Radio

AT the Cook County Fair, in Chicago recently, a new use for radiophoning was demonstrated; giving orders to a race horse as he passed around the track jockeyless. The horse's name was *Radio*, and he had been trained to circle the track at full speed without a jockey, but carrying a light radio receiving set attached to the harness. The owner or trainer of the horse, seated in the grandstand, sent his orders to the horse via radiophone. As the horse came into the home stretch, the trainer yelled in his radiophone transmitter in the grandstand, "Come on Radio! Come on Radio!" whereupon the horse responded nobly, just as if the trainer had been sitting on his back and was urging him on toward the finish line.



The Jockeyless Race Horse Recently Appeared at Chicago. A Radio Receiving Set Was Mounted on the Horse, While the Trainer Directed the Animal Around the Track From a Radiophone Transmitting Set. In the Future, We May Be Treated to a Horse Race in Which No Jockeys Will Participate, the Animals Walking Out Onto the Track, Taking Their Positions, and Running the Race in a Truly Wonderful and Uncanny Fashion.

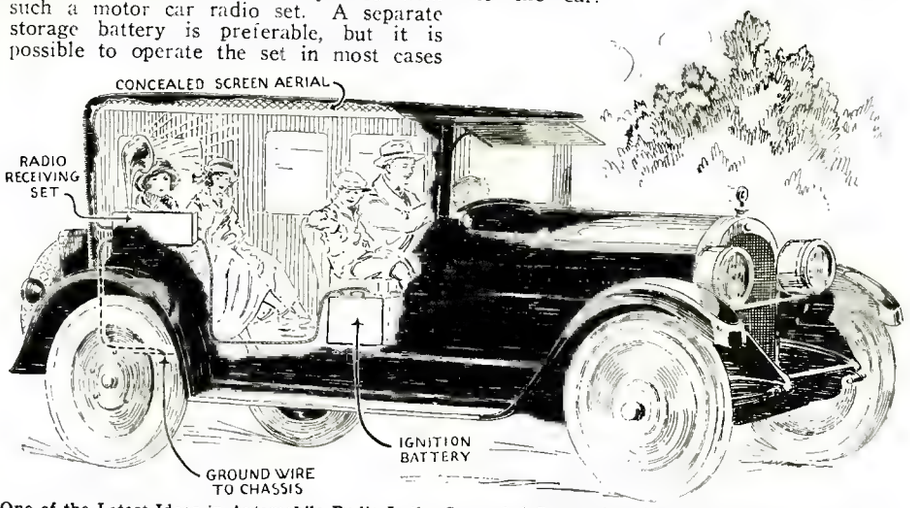
Shortly, perhaps, we will be treated to a distinct novelty in the form of a radio horse race, in which all of the animals participating will race around the track jockeyless, each horse being fitted with a radiophone receiving set, and either a loud-talker horn or else a head-set of phones strapped over his ears.

The radiophone receiving set with which the horse is accoutred, requires at least one stage of radio-frequency, detector, and three stages of audio-frequency amplification, and the form of aerial employed may be a small loop of the pancake or other type, or again the aerial may comprise a wire system combined with a harness. When the loop aerial or its equivalent is employed, no ground is required. There is of course, no danger of an electric shock being received by the horse, and the only difficulty, if such it might be called, lies in the jarring of the delicate instruments, owing to the motion of the horse as he runs along. A special circuit arrangement is also required in connection with a loop or other type of antenna for this horse racing outfit, so that it will not be too critical, with respect to the position in which the aerial points, as if this was the case, the strength of signals would vary from zero to maximum and intermediate degrees, depending upon the position of the horse as he travelled around the curving race track. As aforementioned, this difficulty can be overcome by proper design of the circuit and antenna system. It is possible that in the future we may see farmhorses dragging plows across fields, all the animals being directed by radiophone orders transmitted by the farmer or his hired man from a central spot. It is also possible to direct gasoline engine tractors in the same way, employing sensitive relays connected up to the radio receiving set.

Concealed Aerial in Roof of Auto

A feature of the Closed Car Show held recently in New York City at the Grand Central Palace, was a radio equipped automobile. A copper screen is fixed between the roof and upholstery, thus completely concealing it from view. The metal parts of the machine, being all joined together, form the other plate of a large condenser, having air and passengers as a dielectric, the separation being about five feet.

Radio receiving sets equipped with loud-talkers, so that all the passengers can hear the concerts, etc., are being installed in a number of automobiles nowadays, particularly in public auto buses, one company in California now carrying out extensive experiments with radio receivers on their line of buses. With the concealed metal screen antenna used, as here shown, and by installing the radio set in a flat cabinet, so that it can be placed in the side wall of the car, or possibly in a shallow compartment in the rear of the front seat, very little space is taken up by the apparatus. One stage of radio-frequency amplification, together with a detector and three stages of audio-frequency amplification at least should be used for the average range of work to be accomplished with such a motor car radio set. A separate storage battery is preferable, but it is possible to operate the set in most cases from the ignition storage battery belonging to the car.



One of the Latest Ideas in Automobile Radio Is the Concealed Screen Aerial Trick Here Illustrated. This Metal Screen Aerial Is Concealed Between the Roof of the Car and the Upholstery.

BROADCASTING NIAGARA'S ROAR

Those who have visited Niagara Falls have always been impressed with the tremendous roar accompanying this magnificent display which can be heard for many miles. It has recently been suggested, that the sounds to be found at various points about the falls be broadcasted via radiophone for the benefit of thousands of people who have never heard it. The sound of the Pacific Ocean breaking on the coast of California, has been heard frequently via telephone across the United States, notably a few years ago upon the occasion of the visit of Lord Northcliffe, when this spectacular telephone stunt was arranged in his honor.

Of course it will be rather a novelty to broadcast the roar of Niagara Falls, if one sound from a given point were sent over the radiophone only, but as our illustration herewith shows, it will afford quite a variety of entertainment to have several horns or sound collectors with suitable microphones in them, placed above and below the falls, as well as underneath the falls, so that the director of the broadcasting radio transmitting station situated adjacent to the falls, or even a few miles away if necessary, can, by simply turning a switch, connect quickly any one of the several microphone sound collectors into circuit with the vacuum tube transmitter.

It is possible if desired to pick up the various sounds about this great waterfalls, and transmit these sounds telephonically over a wire circuit to some large broadcasting station, such as that at Pittsburgh "KDKA," or "WJZ" at Newark, from which stations the sounds of the falling waters can be broadcasted via radiophone. This method of indirect broadcasting was resorted to several months ago, when a prize fight was staged in New York and the results of the fight, blow by blow, broadcasted from the Westinghouse radiophone station at Pittsburgh, Pa., or "KDKA." The observer of the prize fight, stationed at the ringside in New York City, talked to a microphone connected with a specially leased wire telephone circuit to Pittsburgh, where his voice was automatically transferred into the radiophone broadcasting apparatus, and radiated in the form of etheric waves for several thousand miles in all directions.

Imagine the novelty of this broadcasting of Niagara's roaring waters, especially to those living at a great distance and who have never seen the falls, particularly people living abroad. The art of radiophone broadcasting is only in its infancy, and tomorrow we will no doubt be treated to extremely interesting and enlightening concerts and lectures. We shall hear the noise of the riveters as they turn out an automobile in a short time, or the blows of the hammers in the great locomotive works and steel foundries, et cetera.

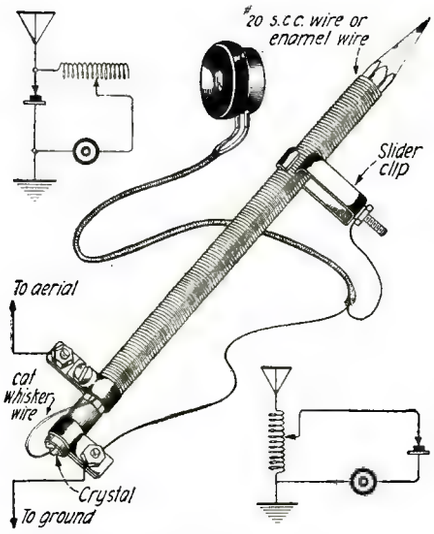
PAUL

The Simplest Radio Outfit Contest

By GEORGE GOGA

(WINNER OF SEVENTH PRIZE, $25.00 IN $300.00 RADIO RECEIVING CONTEST)

BELOW is described the simplest receiving set, which has been awarded seventh prize in our contest. The set is extremely compact and easy to build, the only real cost being that of the receiver, as the other parts are just odds and ends which can be found in any home "junk-box."



This Illustration Shows the Circuit Connections for the Radio Receiving Outfit Built by Mr. Goga on a Lead Pencil. The Tuning Coil, Detector and Telephone Receiver, May Be Connected in Several Ways, Two Preferred Circuits Being Given Above.

The body of the set is composed of a pencil with a brass tip into which is normally inserted an eraser. The eraser is removed and a piece of galena forced into the brass cylinder. Around this cylinder is clamped a brass strap, as shown in the illustration. The bolt passing through the end of this strap serves as a binding post and provides for the connection to be made to the crystal.

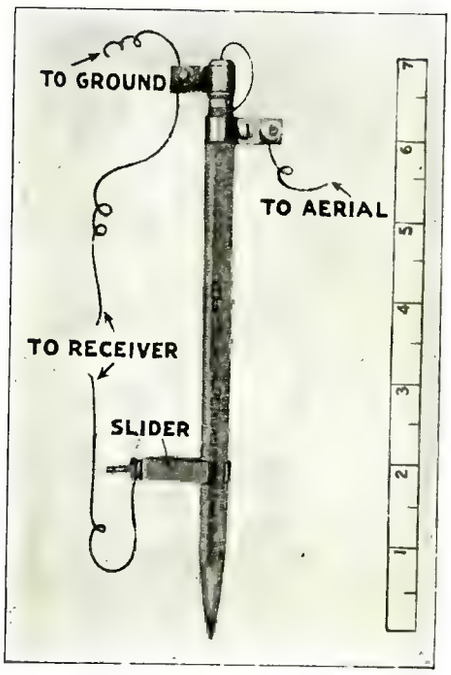
Another clamp is provided, which is placed around the pencil about ¼ inch down from the brass cap. For the tuning coil several feet of No. 22 D.C.C. magnet wire will be necessary. About 1½ inches of one end of this wire is scraped and placed under the latter mentioned clamp in such a way that the bare end extends toward the brass cap and forms a cat-whisker contact for the crystal. The rest of the wire is now wound on the pencil in a single layer to about ½ inch from the pointed end. The wire is fastened by scraping the insulation from the end of the last turn and from the adjacent turn and soldering the two together.

The next step is to scrape the insulation from the wire for the entire length of the coil in a path about 3/16 inch wide. After this is done a clamp is made as shown in the illustration which serves as a slider.

Both of the end clamps and the slider should be made of spring brass or phosphor bronze ¼ inch wide.

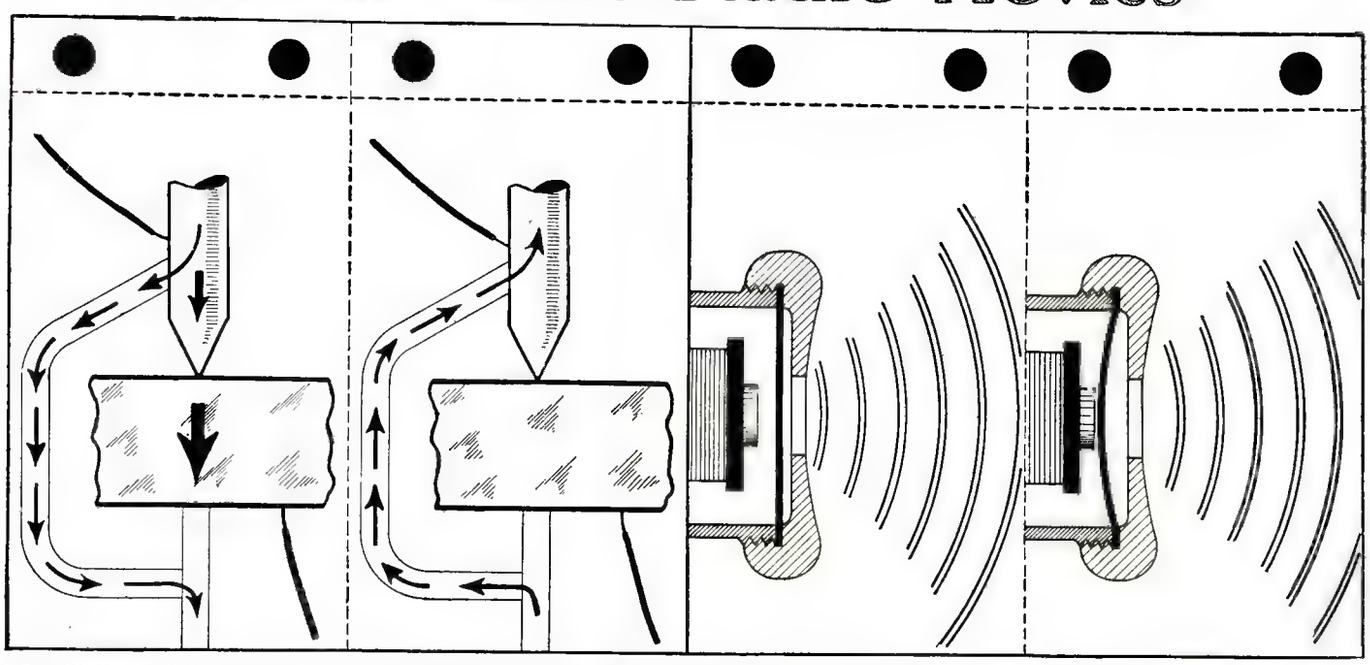
After the set is constructed it is connected up with either of the two hook-ups illustrated.

This set when used in connection with a 1000-ohm receiver, which cost the builder $2.25, received radiophone concerts from KDKA when in use several miles from the station. In this case the aerial consisted of a single wire, 50 feet long and 10 feet high. The assembling of this set may be made cheaper by using an 80-ohm watch-case receiver. Mr. Goga tried this and found that the set worked very well with it.



The Photograph Above Shows the Actual Appearance of Mr. Goga's Complete Radio Receiving Set on a Lead Pencil. The Inductance of the Tuning Coil Is Varied by Moving the Slider Along the Pencil. The Galena or Other Mineral Is Placed in a Suitable Metal Cup or Even the Brass Ferrule Ordinarily Supporting the Eraser, While the Cat-Whisker Wire Loops Over on Top of It.

Home-Made Radio Movies



At Last We Have It! Home-Made Radio "Movies." All You Have to Do Is to Cut Out the Four Drawings Here Reproduced, and Pin the Two Corresponding Sheets of Either Set One Over the Other, So That by Holding the Bottom One at the Lower Left-Hand Edge, and Flipping the Top One Up and Down Rapidly, by Its Lower Right-Hand Edge, a Real "Movie" Action Ensues. Better Results Can Be Obtained by Gluing the Under Sheet to a Piece of Thin Cardboard, So as to Make It Stiffer. Many Other Simple Ideas Like Those Here Shown Will Occur to the "Radio-Bug," Who Can Easily Draw Some More of These for Himself. These Pocket Radio "Movies" Can Be Made Quite Instructive as Well as Interesting. If You Want to Make a Real Good One Some Winter Evening, When Time Hangs Heavy on Your Hands, Try to Make One of These "Movies" Showing the Action Occurring in an Audion. If You Make a Real Good One, Send a Copy of It to the Editor, and if We Like It We Will Be Glad to Publish It and Pay You For It. Other "Movie" Ideas Are Also Welcome. Set at Left Shows Rectifying Property of Crystal Detector; Set at Right—How a Telephone Receiver Works.

$100.00 Prize Contest

For Best Radio "Interference Preventer"

RADIOPHONE concerts, so far as their reception is concerned, are not always the simplest and most pleasing affairs one might imagine. Those who have been receiving these concerts for some length of time have no doubt been troubled frequently with interference from other radiophone stations, as well as radio-telegraph spark and continuous wave (CW) stations, who come in on the same or nearly the same wave lengths. Unless one is very experienced in handling a radio receiving set, or unless special tuning arrangements are provided in the form of variable condensers, etc., it is frequently impossible to completely tune out at will the interfering station or stations.

Recently the Radio Editor of this journal was talking to one of Uncle Sam's naval radio experts in New York City, who assists in the operation of the Brooklyn navy yard wireless station, and he made several interesting suggestions of interest to radio enthusiasts, especially those who are listening to the daily concerts transmitted by this medium. He said, in so many words, that radio amateurs in general frequently criticized or complained of the interference from Government and commercial radio telegraph stations, not to mention radiophone broadcasting stations operating in the same zone, and on a wave length close to that used by the station to which he might be listening at the moment. He said—"It is all a matter of tuning and not the Government station's fault." He explained how at his home, situated about one-half mile from the powerful Brooklyn navy yard station, and about the same distance from the Bush Terminal station, he can tune out either one of these radio telegraph stations at will, using a short wave regenerative receiving set, comprising a detector and two stages of amplification.

FIVE PRIZES IN RADIO "INTERFERENCE PREVENTER" CONTEST

First Prize	**$50.00**	**in gold**
Second "	**20.00**	**" "**
Third "	**15.00**	**" "**
Fourth "	**10.00**	**" "**
Fifth "	**5.00**	**" "**

Total, $100.00

We, therefore, believe that this contest offering five cash prizes for the best and simplest interference preventers, will prove of wide-spread interest to all radio experimenters. One of the prime requisites of the wrinkle or idea you develop, or are already using, to make your set selective in order to be able to tune out interfering stations, is that the arrangement must work in practice, and must have been demonstrated to accomplish the results claimed. **The device must tune out a 360 meter wave when it is desired to tune in a 400 meter wave.** We will not accept entries which are purely theoretical, and drawn up in diagram form only. Of course the preliminary entries may be written up with diagrams and photos in the regular way, but when the judges come to select prizes they reserve the right to require that the apparatus shall be shipped to them for actual test. A careful test will be made with the instrument or device employed as the interference preventer in the "Radio News" Radio Laboratory, by a competent radio engineer, and in this way the various merits of each of the potential prize winners firmly established by actual test.

Keep the description as brief as possible, three hundred to five hundred words being amply sufficient, together with a diagram and a photo, if you happen to have one handy. No manuscripts entered in this contest can be returned, and we reserve the right of paying regular space rates to publish all worthy ideas which do not win a prize. Use ink not pencil, in writing articles, and make sketches on separate sheets. This contest is open to everyone, including radio clubs, except radio manufacturers.

This contest closes at noon January 15th. Should two contestants submit the same idea, a similar prize will be paid to both. Address all communications or apparatus to—**Editor, Radio Interference Contest,** in care of this publication.

World Radio Plant Project in Holland

As a result of the late war, when Holland was entirely cut off from all direct cable communication with her colonial possessions and the outside world, and was entirely dependent on foreign cables, great efforts have been made of late to provide the Netherlands with direct wireless service both to her colonies and to the United States.

With this aim in view the Dutch government is establishing a very powerful wireless sending and receiving station at Kootwyk, in the Province of Gelderland, covering an area of 750 acres. Kootwyk is some distance from the seat of government, but it was chosen on account of the country being more elevated than near the principal cities of the Netherlands.

Still another station for receiving will be established thirty miles southward. Five masts, 700 feet high, have been erected at Kootwyk, weighing 100 tons each. The work is being directed and the materials supplied by the German Telefunken Company, and the station is expected to be ready for service at the end of the year, when it is said it will have the same capacity as the Long Island station and will also be one of the biggest in the world.

Kootwyk Station will be equipped with a special duplex system to receive and send simultaneously to and from Java, 7,500 miles distant.

Diplomatic negotiations are now being carried on to make the new station available for American traffic after sunset, as the station cannot communicate with Java during the whole twenty-four hours owing to atmospheric conditions.

The station will be equipped with an aerial energy of 400 kilowatts and probably will be obliged to use a 12,000-meter wavelength in order to prevent jamming, although, according to experts, 8,000 to 9,000 meters would be preferable.

There is a growing feeling that with the ever-increasing number of sending and receiving stations, it is absolutely necessary to fix the use of wave-lengths internationally as soon as possible, especially as discussions both in Washington and Paris brought no results. It is felt that the present system of makeshift agreements cannot be continued much longer. As reported recently, other negotiations regarding a direct cable to America are also being carried on.

What I Would Like to See Published in "Science and Invention"

It has always been the desire of the Editor to publish what the readers want, not "what strikes the Editor's fancy." As a rule we believe that we publish such material as is of greatest interest to our readers. From time to time, however, it is necessary to check up to see whether our guess is right, for, after all, in publishing a magazine such as this, there is some guess-work connected with the articles to be published, wherefore we shall put it up to our readers from time to time, to make sure that we publish just what they desire.

On the blank space below, please list your preferences of certain articles, or class of articles, that you would like to see printed in this magazine. The Editors will try their utmost to comply with the wishes of the majority. The results of this work will be published from time to time:

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Name .....

Street Address.....

City or Town..... State.....

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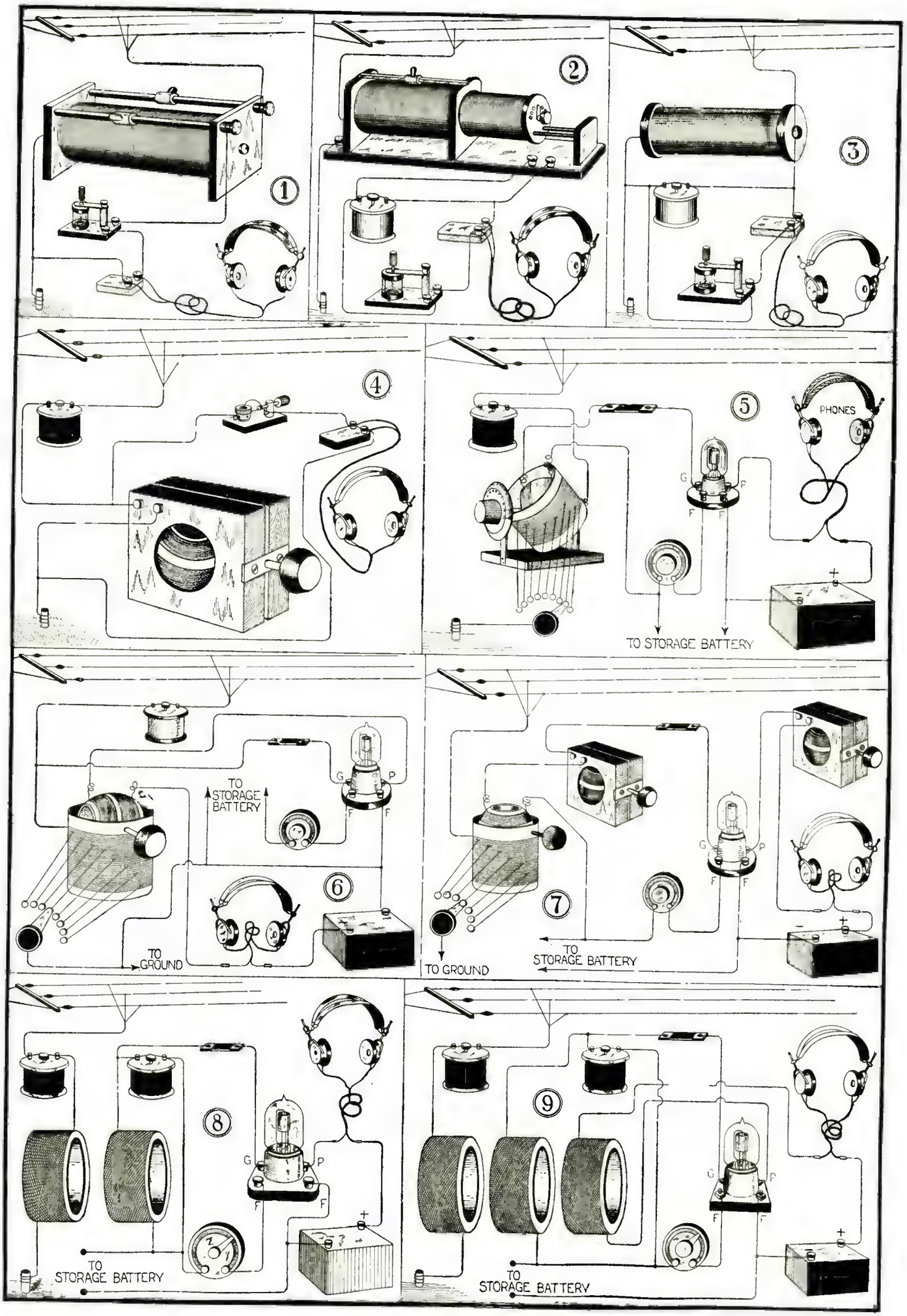
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Radio Tuning Devices and Circuits

By A. P. PECK

MANY are the letters which come to the editors of this and other magazines, asking for a hook-up of "a crystal receiving set" or "an audion receiving set," without the least mention of what kind of a tuner the writer wishes to use. It is obviously impossible to answer this question correctly without asking for further information from the questioner. For just this reason this article is written; that is, to acquaint our readers with the simplest and most efficient tuning apparatus, as well as the hook-ups used with each.

Tuners may be roughly classed in the following groups, and hook ups for each will be found on the opposite page; Tuning coils, loose couplers, vario-couplers, variometers, and honey-comb coils. Of course, under the first heading will come one-slide, two-slide and three-slide tuners as well as the tapped coils sometimes used as loading or tuning coils. Under the second will come all types of couplers in which the secondary or inside coil slides in and out of the primary or outside coil. This includes both the so-called "navy" type with tapped primary and tapped secondary, as well as the type which employes a slider on the primary and a tap-switch on the secondary. Both styles are hooked-up in the same way.

Under vario-couplers there are two well-known types, which are called 90° and 180° coupling vario-couplers, as the case may be. In neither style is the secondary tapped. In the first-mentioned type, the secondary or inside winding is generally placed on a round ball and mounted on a shaft, which runs parallel with the base of the instrument, in such a way that the relation between the primary and secondary windings may be changed at will. This form of vario-coupler is provided with a variable primary, which, for best results, should be tapped in both units and tens. In the 180° type, the same holds good for the primary, as for the primary in the 90° style. The difference, however, is found in the method of mounting the secondary. The shaft, in this case, is run through both the primary and the secondary from one side to the opposite side at an angle. This construction is clearly shown in Fig. 5. The advantage of this type is at once noticeable, in that the relation between the primary and secondary is constantly variable through a full half turn, while in the former type, the relation is only variable through a quarter turn, after which the degree of coupling merely repeats itself. Either of these couplers may, of course, be used in any circuit diagram which calls for a vario-coupler, without any change in the hook-up. The advantage, however, lies with the 180° type, inasmuch as it allows sharper tuning—an important factor in C.W. or radiophone reception.

Under the heading of variometers, we find only one general type. This is the well-known form with two coils, one placed rotatably within the other, and the two connected in series. The forms of windings vary somewhat, according to the manufacturer's idea of efficiency. On some, the stator, or stationary winding is placed on the outside of the tube, and in some cases on the inside. The latter is generally conceded to be the best as it provides a closer inductive relation between the two coils. Another form of winding is that known as the lattice-wound variometer. This is merely the spider-web form of winding applied in a spherical form.

Honey-comb coils are comparative newcomers in the field of radio, inasmuch as they were developed during the late war. Their form and appearance is known to practically every amateur and therefore we will not go into detail on that subject in the present article. Of course, one of the greatest advantages of these coils is their compactness and the ease with which it is possible to change wave-lengths with them. More will be said regarding the mountings of them in a later part of this article.

Now we come to the explanation of the diagrams which are shown here. In the first drawing we have a hook-up of a two-slide tuner used in conjunction with a crystal detector. In all crystal receiving sets, a small fixed condenser with a capacity of about .01 m.f. is almost invariably found advantageous when shunted across the phones. This condenser is shown in all the crystal detector circuits. In Fig. 1, the antenna circuit is tuned by means of one slider, and the closed oscillatory circuit by the other. A variation of this circuit would be to use a three-slide tuner and connect the ground to the third slider instead of the end of the wire. This will give somewhat sharper tuning.

In Fig. 2, a loose coupler and variable condenser are used for tuning. This circuit will give more selective tuning than the circuit shown in Fig. 1, but in most cases will not yield as loud signals as the former. However, this circuit has been found very satisfactory for all around reception, especially on the intermediate wave-lengths, that is, around two thousand to three thousand meters. The variable condenser across the secondary provides a means of tuning the latter more sharply than can be accomplished with the tap switch usually supplied on the secondary of a loose coupler.

In the circuit diagram, given in Fig. 2, a vario-coupler may be substituted for the loose coupler for short wave work. However, many amateurs say that a vario-coupler does not give as good results as a loose conpler when used with a crystal detector. This, the writer believes, is merely a matter of preference, and among the "old-timers," a sort of sentiment for the old trusty coupler which did such good work "before the war" when a "ham" would sit all night and listen to spark signals, which are now called nuisances and other things too harsh to repeat here.

Fig. 3 shows what is probably the acme of simplicity in a crystal receiving set. The inductance is of the fixed type and may be one of many different forms. Honey-comb, spider-web and cartridge type coils lend themselves very well to this circuit. These should be so mounted as to be readily interchangeable, so as to allow reception over a wide range of wave-lengths. The variable condenser should be of the 43 plate type, with a capacity of .001 m.f., although any other condenser with that capacity may be used. The method of using this set is to insert a coil whose inductance covers the wave-length on which it is desired to receive, and slowly vary the condenser over its entire range or until the signals are heard. This type of tuner has been found to be fairly efficient for all-around work, as it allows one to cover a large range of wave-lengths, merely by changing the coil from one size to another.

In circuit No. 4, we have another simple crystal receiving set. There are only two controls to adjust, aside from the crystal detector. The variometer may be of any standard make now on the market, but for the very best efficiency, it should be of the type having a molded stator and rotor. If the variometer is to be home-made, it should be wound with approximately an equal number of turns on both coils. The variable condenser in this circuit may have either 23 or 43 plates, the exact size being almost immaterial. However, the larger size will probably give slightly better results.

The circuit diagram in Fig. 5 is one of the simplest and easiest operated, yet efficient for use with an audion detector. A 180° vario-coupler is shown, although the 90° type may be used with very good results if desired, or if handier to obtain. As said before, however, the former style will give sharper tuning, and consequently greater selectivity, and more freedom from interference. The condenser may be of the 23 plate type, and is placed in series with the antenna in order to give finer tuning to the primary.

In hooking-up any audion circuit, it should always be remembered that the positive (plus) terminal of the "B" battery must always be connected to the plate, even though the circuit is through other instruments before the "juice" gets there. This may be very easily remembered by the fact that the two "P's" go together, that is, positive and plate. The matter concerning which pole of the "A" battery the negative side of the "B" connects to can most satisfactorily be decided by experiment. Try both connections and use the one which gives the best results.

A very simple regenerative or "feed-back" circuit is shown in Fig. 6. Here a standard vario-coupler is used and the secondary, connected in the plate circuit, provides a means of regeneration, which practically means detecting and amplifying with the same tube. This circuit is known as a single circuit tuner. The secondary or tickler as it is called when used in this way, feeds back the audio frequency current, that is, the detected signals, to the grid of the tube and they are amplified by the same tube which detected them, after which the fluctuating currents are made audible by the telephone receivers. This is the circuit which gives so much trouble in districts where there are several receiving sets in close proximity to each other. The reason is that this set acts as a miniature transmitter

(*Continued on page* 809)

List of Interesting Articles Appearing in December Issue of "Radio News"

Regeneration and Super-Regeneration. By Jesse Marston.

The Influence of Horn and Diaphragm on Sound Waves with Special Reference to Radio Loud-Talkers. By Herbert Metcalf.

Radiation from the Receiving Set. By C. L. Whitney.

Broadcasting by Wired Wireless. By R. D. Duncan, Jr.

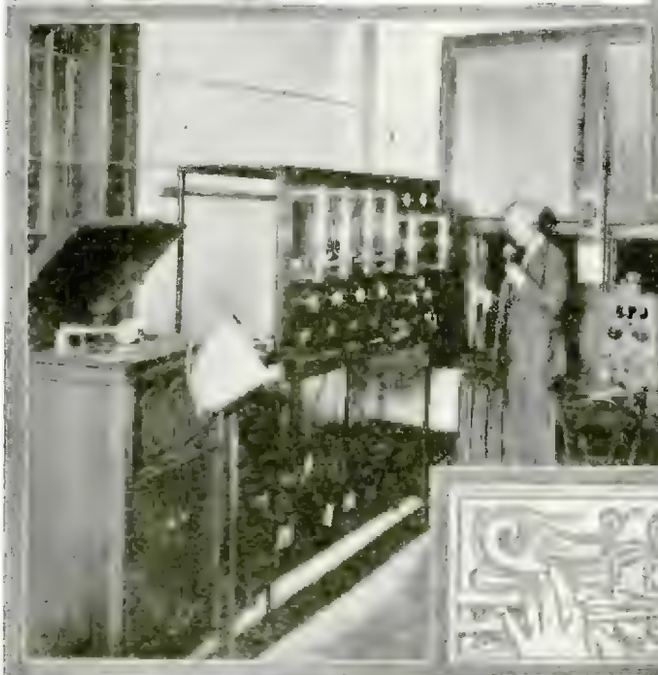
Construction of a Modulation Transformer. By Charles K. Fulghum.

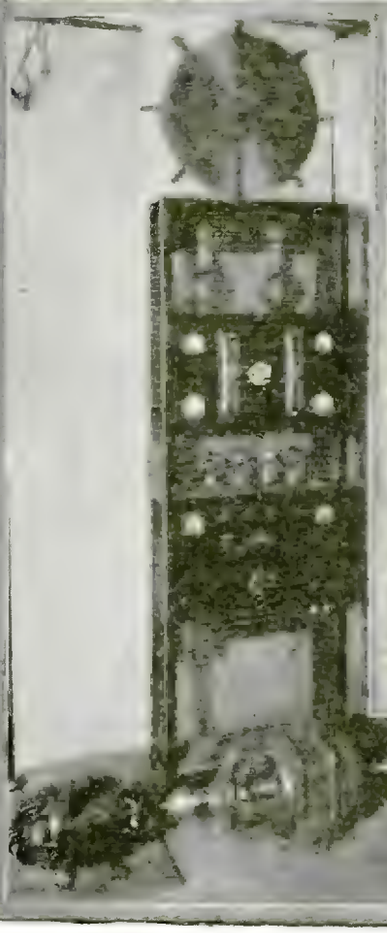
Some Experiments with Very Short Waves. By D.R. Clemons.

Some Experiments with Low and Underground Antennae. By M. Guierre.

BROADCAST STATIONS

The Two Photos Below Show the Radiophone Broadcasting Station Maintained by a Canadian Newspaper, "The Leader," at Regina, Sask. Photo at Right Shows the Elaborate Antenna System Erected on the Roof of the Leader Building. Call Letter, CKCK. Photo at Left Shows the Operating Room of Station CKCK.





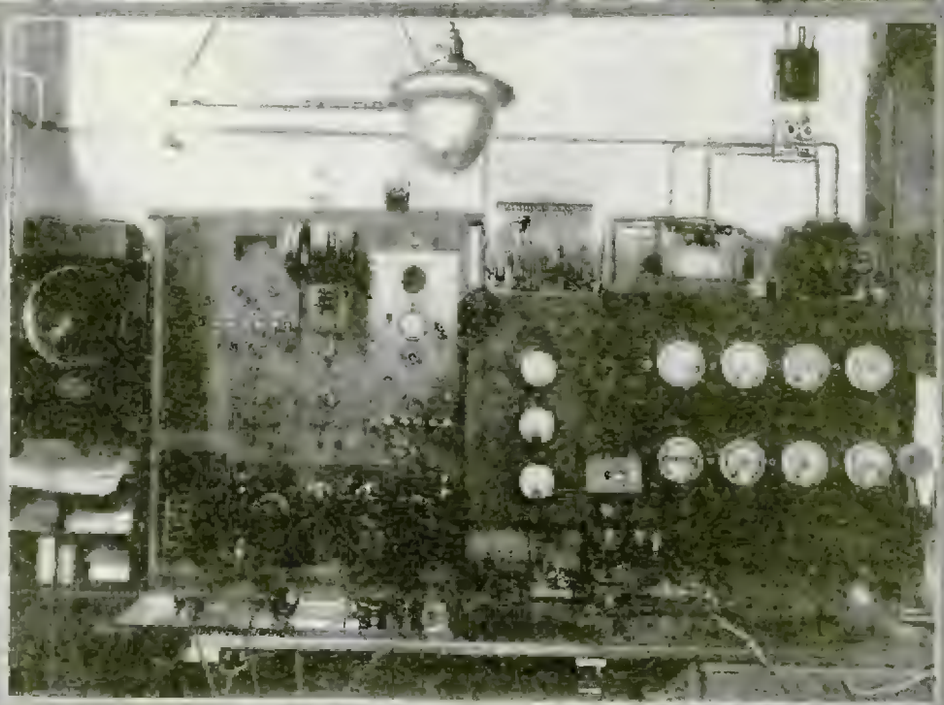
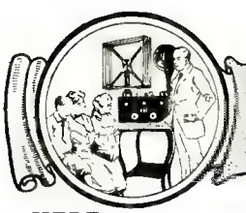


Photo Above: Radio Broadcasting Station 9ZL (Ex-9GK), Operated by Quinn Brothers, at Neenah, Wis. This Station Has Been Heard in Every State, Also Canal Zone, and by 6ZAC in Hawaiian Islands.

Photo at Left: Transmitting Panel With Power Tubes and Motor Generator Set at Broadcasting Station WOQ, Operated by the Western Radio Co., Kansas City, Mo.



RADIO BROADCAST

THERE are so many broadcasting stations which have forwarded information, that we regret we have only space enough to print a very few. Those stations which have been courteous enough to submit photographs will find that the photos will be published in due time. The stations listed on this sheet will not be published in the next issue. We would suggest to our readers that the map locations indicated on this page are for the special supplement map given free with the May issue of SCIENCE AND INVENTION. At a great expense this list of the stations has been practically completed as far as commercial broadcasting stations are concerned. We will present our readers with additional information on the new stations as it is brought to our attention. Address all communications to Editor Radio Broadcast, c/o SCIENCE AND INVENTION MAGAZINE, New York City.

ELABORATED LIST GIVING TIME AND NATURE OF BROADCAST (Continued from previous issues)

Call Letter	Name	City	State	Wave Length
WDAH	Mine & Smelter Supply Co. Weather, lectures, market reports, music, vocal and instrumental music, sermons, baseball scores, news bulletins and special features Tuesdays, Thursdays and Saturdays 7.30-8.30 P. M. Mountain time. Consistent range 500 miles. Maximum 2,000.	El Paso	Texas	360
WDAL	Florida Times-Union. Weather, lectures, market reports, music, vocal and instrumental talent and baseball scores daily except Sunday 3.00-3.15 P. M., 4.00-4.15 P. M., 5.00-5.15 P. M., 7.30-9.30 P. M. Consistent range 200 miles. Maximum 1,000.	Jacksonville	Fla.	360
WDAO	Automotive Elec. Co. Lectures, music, vocal and instrumental talent and special features every day 12.30 M. to 1.00 P. M., 6.00-6.15 P. M., 7.30-8.00 P. M Consistent range 50 miles. Maximum 100.	Dallas	Texas	360
WDAP	Midwest Radio Central, Inc. Time signals, lectures, market reports, music, vocal and instrumentaltalent, baseball scores, news bulletins and special features, Mondays, Wednesdays and Fridays 9.45 A. M., 10.45 A. M., 11.45 A. M., 1.45 P. M., 3.10 P. M., and 6.00 P. M. Tuesdays and Thursdays 9.45 A. M., 10.45 A. M., 11.45 A. M., 1.45 P. M., 3.10 P. M., 6.00 P. M., 7.30 P. M., 10.00 P. M. Saturdays 9.45 A. M., 10.45 A. M., 11.45 A. M., 1.15 P. M. Sundays 8.30 P. M. Consistent range 300 miles. Maximum 1,000.	Chicago	Ill.	360
WDAY	Fargo Radio Service Co. Weather, lectures, music, vocal and instrumental talent, baseball scores, news bulletins and special features daily 12.15-12.30 M. Every day except Sundays 7.30-8.00 P. M. Mondays, Wednesdays and Fridays 9.00-9.30 P. M. Central time. Consistent range 250 miles. Maximum 500.	Fargo	N. Dak.	360-485
WDZ	J. L. Bush. Market reports, music, news bulletins and special features daily except Saturdays and Sundays half hourly from 8.30 P. M. to 12.15 M. Saturdays half hourly from 8 30 A. M. to 11.00 A. M.	Tuscola	Ill.	360
WEAB	Standard Radio Equipment Co. Lectures, weather, music, vocal and instrumental talent, sermons, baseball scores, news bulletins and special features daily 7.30 P. M. Sundays 11.00 A. M. Central Standard time. Consistent range 200 miles. Maximum 550.	Fort Dodge	Iowa	360
WEAC	Baines Electric Service Co. Weather, lectures, music, vocal and instrumental talent, baseball scores, news bulletins and special features daily except Sundays, 10.30 A. M., 12.00-1.00 P. M., and 5.00-6.00 P. M. Tuesdays, Thursdays and Saturdays 8.00-10.00 P. M. Consistent range 200 miles. Maximum 1,000.	Terre Haute	Ind.	360
WEAD	Northwest Kansas Radio Supply Co. Weather, time signals, market reports, music, vocal and instrumental talent, sermons and news bulletins daily except Sundays, 10.00 A. M., 11.00 A. M., 1.00 P. M., 6.00 P. M., and 7.00 P. M. Sundays, sermons morning and afternoon. Central Standard time. Consistent range 150 miles. Maximum 1,000.	Atwood	Kansas	360
WEAH	Wichita Board of Trade and Lander Radio Co. Weather, market reports, music, vocal and instrumental talent, news bulletins, special features daily, hourly from 8.40-11.40 A. M., 12.30-3.15 P. M. Wednesdays and Saturdays 8.00 P. M. Every third Sunday 8.00 P. M.	Wichita	Kansas	360-485
WEAN	Shepard Co. Weather, lectures, music, vocal and instrumental talent, baseball scores, news bulletins and special features daily except Sundays 3.00-5.00 P. M., daily except Wednesdays and Sundays 6.00-8.00 P. M. Mondays 8.00-10.00 P. M. Wednesdays 6.00-10.00 P. M. Standard time. Consistent range 50 miles. Maximum 100.	Providence	R. I.	360
WEAO	The Ohio State University. Weather, lectures, market reports, news bulletins and road conditions in Ohio, daily except Sundays, 1.30-4.00 P. M. Eastern Standard time. Consistent range 50 to 75 miles.	Columbus	Ohio	360
WEAS	Hecht Co. Lectures, music, vocal and instrumental talent, baseball scores, news bulletins and special features daily except Sunays 3.00-4.00 P. M. Wednesdays and Fridays 7.30-8.30 P. M. Eastern Standard time. Cosistent range 50 miles. Maximum 100.	Washington	D. C.	360
WEW	St. Louis University. Weather, marked reports, special features. Every day except Saturday and Sunday 10.00 A. M. and 2.00 P. M., Saturdays 10.00 A. M. and 1.00 P. M. Consistent range 125 miles. Maximum 150.	St. Louis	Mo.	360-485
WFAA	A. H. Belo & Co. Weather, lectures, market reports, music, sermons, baseball scores, news bulletins, special features. Consistent range 150 miles. Maximum 1500. Central time.	Dallas	Texas	360 485
WFAC	Superior Radio Co. Lectures, music, baseball scores, news bulletins, special features. Daily except Sunday from 8.00 to 9.00 P. M. Central time. Consistent range 100 miles. Maximum 500.	Superior	Wis	360
WFAD	Watson Weldon Motor Supply Co. Weather, lectures, market reports, music, sermons, baseball scores, news bulletins, special features. Every day except Saturday and Sunday 8.40, 9.40, 10.40, 11.40 A. M., 1.30, and 4.00 P. M. Tuesdays, Thursdays and Fridays 8.00 P. M. Saturdays 8.40, 9.40 10.40, 11.40 A. M. and 1.30 P. M. Sundays 11.00 A. M. and 7.45 P. M. Consistent range 100 miles. Maximum 250.	Salina	Kan.	360
WFAF	H. C. Spratley Radio Co. Weather, lectures, market reports, music, baseball scores, news bulletins, special features. Every day except Sunday from 10.00 to 10.30, 11.30 to 11.45 A. M., and 1.30 to 2.00 P. M. On Tuesdays, Thursdays and Saturdays 8.15 P. M. Consistent range 300 miles. Maximum 1500.	Poughkeepsie	N. Y.	360
WFAG	The Radio Engineering Lab. Lectures, music, news bulletins, special features, on Wednesdays and Saturdays from 7.45 to 10.00 P. M., and on Sundays from 2.00 to 4.00 P. M. Eastern Standard Time. Consistent range 500 miles. Maximum 900.	Waterford	N. Y.	360
WFAM	Times Publishing Co. Weather, lectures, market reports, music, baseball scores, news bulletins, special features, daily except Sundays from 3.30 to 4.00 P. M., and from 7.30 to 9.00 P. M. Consistent range 75 miles.	St. Cloud	Minn	360
WFAN	Hutchinson Electric Service Co. Weather, lectures, market reports, music, news bulletins, special features, daily except Sundays, from 12.55 to 1.30 P. M. Central Standard Time. Consistent range 100 miles. Maximum 300.	Hutchinson	Minn	360-485

(*Continued on page 782*)

Radio for the Beginner

By ARMSTRONG PERRY

NO. 10—HOW TO ORGANIZE YOUR TOWN FOR RADIO SERVICE

HUMANITY discovered radio as a child discovers fire. First an effect was observed, like a gleam of light from afar, which could not be ascribed to any known cause. In experimenting with electricity scientists saw things happen that were not the result of a flow of current from a generator to the apparatus in which they happened, nor of the induction of current, according to any known law, in that apparatus by a current flowing in other apparatus. An English scientist proved by mathematical calculation that radio waves must exist. A German carried out the physical experiments and proved that they did exist. Inventors got busy on apparatus and showed how to produce, control and use radio waves and a distinguished Italian demonstrated how they could be converted into practical use.

Commercial radio was gradually developed on business principles. A small group of men followed the light, found the fire and learned how to make it work for them.

Then followed the technical radio amateur, the idealistic child. His enthusiasm for play is as inexhaustible as that of a boy with his Fourth-of-July firecrackers. He developed much ingenuity in originating devices for making himself heard far and wide. Often he grew up into a commercial radio man but even then he frequently retained enough of the child spirit, to play off and on with things in which money had no part, except as the need arose for more firecrackers.

Enthusiasm begets enthusiasm, and when commercial radio saw the advantage of getting the rest of the population interested and capitalizing their interest, there were enough amateurs everywhere to stir up the necessary excitement and the general public crowded around the fire and fought for a chance to get burnt, or at least to get smoke in their eyes.

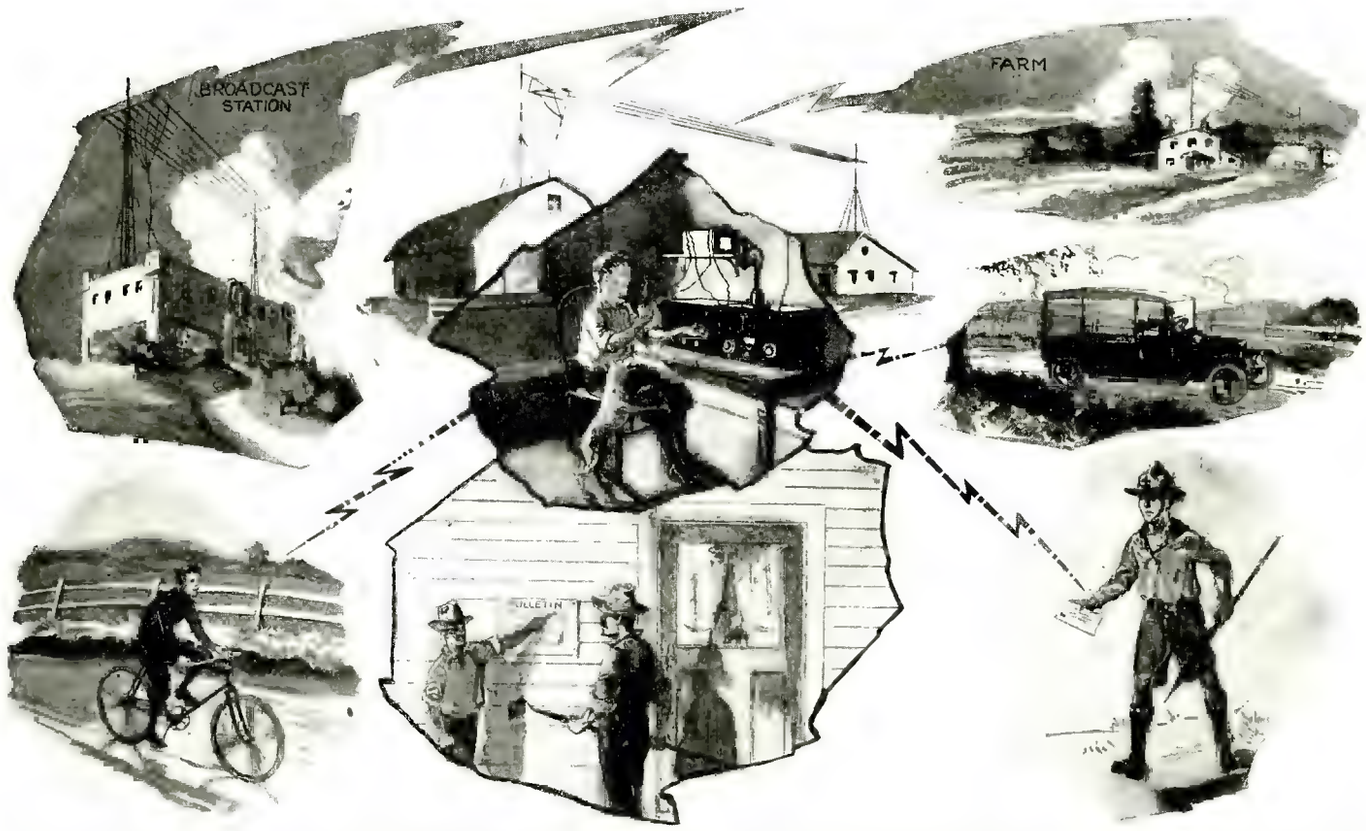
With many the excitement of radio has already waned. They heard a few concerts, lectures and sermons, the novelty wore off and they turned to other pastimes. The fire begins to need poking. Those whose money is tied up in popular radio are scurrying about for new fuel. Strangely enough neither the radio public nor the manufacturers and dealers have awakened to the fact that the fire, in addition to furnishing amusement with its sparkling light and comfort with its warmth, can also produce steam in any locality to turn the wheels of progress. The radio beginner in almost any town or city could start today and get the jump on the commercial companies, the radio manufacturers and dealers and the technical amateurs by concentrating on the practical problem of fishing out of the air the valuable information that floods it and applying this to the needs of his own community.

Modern business needs quick information more than it needs anything else. A few years ago a tanner could manufacture black leather with the assurance that within a reasonable time he could sell it. He used a process that required months from hide to wearer, yet nothing happened while the goods were in the works to destroy the market. Today a tanner who took that much time would find that the fashion had changed, perhaps several times within a half year, and that his black leather would not sell anywhere because the public was buying tan, gray, bronze or some other color. Everything has speeded up and he must have quick information. Bankers, brokers and farmers who do not keep in daily touch with markets and business conditions are the small fry, that fatten the big fellows who are "in the know." All business and professional men must keep up to the minute or lose prestige and profits.

Radio, as compared with communication, that makes use of the printing press, is like the 200-mile-an-hour airplane that whizzes past the ox cart, only more so. We will continue to read newspapers, but the town that butts the others off the map will be the one whose citizens get important news, *while it is news*, by radio.

Already the air is full of information. While the radio novice is fishing for a concert and getting an occasional note or whistle, there are always passing his receiver waves that are far easier to handle and that carry news that is worth dollars. By using the following suggestions or some adaptation thereof I am just as confident that a beginner in radio could add to the wealth and importance of his town and to his own resources as I am that piling one brick on another makes a pile two bricks high.

(*Continued on page* 811)



In the Present Article by Mr. Perry, the Importance of Organizing Your Home Town or District for Radio Service, Is Dwelt Upon at Length. If You Own a Good Radio Receiving Station, the Chances Are That You Can Arrange to Disseminate the Important Information, Such as Weather Reports, Etc., to Those Living in the Outlying Districts, With the Aid of Boy Scouts or Other Messengers, Organized to Aid in the Work; Also by Re-Broadcasting Such Public Welfare Reports, Either by Radiophone or Slowly by Code, for the Benefit of Those Possessing Receiving Sets.

Radio Oracle

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c is made for all questions where a personal answer is desired.

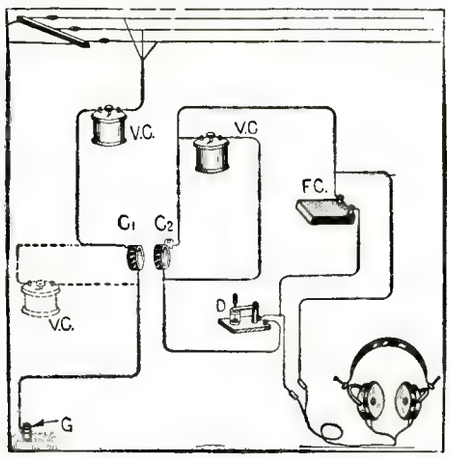
HONEYCOMB COILS WITH CRYSTAL DETECTOR

(79) L. V. Mincemoyer, South Williamsport, Pa., says:

I have four variable condensers, capacity .001, three with a capacity of .0001, three honeycomb coils, a crystal detector and a fixed condenser, and he asks:

Q. 1. How should I connect them up?

A. 1. You will only need two variable condensers and two honeycombs in connection with your crystal detector and fixed condenser, but you will also need a pair of phones. We give herewith a circuit diagram of the same.



We Show Herewith a Diagram of a Circuit Using Honeycomb Coils in Connection With a Crystal Detector. The Position of the Primary Condenser is Optional, and the Condenser May be Used in Either Place Indicated.

LONG WAVE ANTENNA

(80) J. D. Fraley, McMinnville, Tenn., asks:

Q. 1. Will you please inform me how many wires are needed and how long they should be for an antenna to be used for the reception from the trans-Atlantic stations?

A. 1. The number of wires does not matter materially, one wire 600 feet long answering the purpose admirably. Seven-strand phosphor bronze cable is advisable, although any size of wire from No. 14 up can be used.

Q. 2. How far from the aerial should the leads of a multi-wire aerial be connected together?

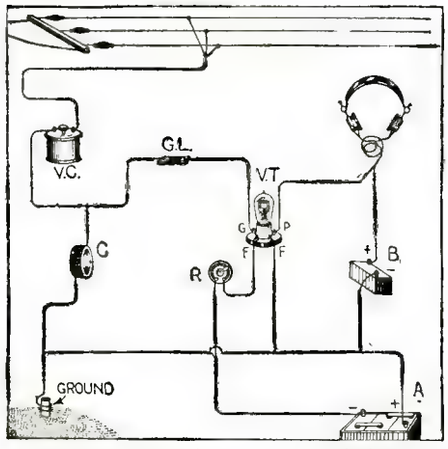
A. 2. The distance does not matter, but the entire lead-in should have a cross-sectional area equal to the sum of the cross-section areas of all the wires in the antenna. In other words, if you have a seven-wire aerial, the lead-in should consist of either seven strands of the same size as the wire in the aerial, or one wire equal in cross-sectional area to seven strands of the size used in the antenna.

ONE HONEYCOMB COIL WITH AUDION DETECTOR

(81) A. G. Gaylor, Little Falls, Calif., asks:

Q. 1. Please give me a hook-up for one honeycomb coil, a variable condenser, and an audion detector.

A. 1. We give herewith the circuit diagram you request.



A Very Simple Tuner for Use With an Audion Detector is Shown Herewith. Only One Honeycomb Coil and One Variable Condenser are Necessary.

TUNING COIL QUERIES

(82) Thos. F. Meher, Yonkers, N. Y., says:

In winding a tuning coil, one end of the wire is connected to the ground, and asks:

Q. 1. Where is the other end connected?

A. 1. Only one end of the wire, wound on the tuning coil, is used. The other end is not connected in any way.

Q. 2. Must the wire on the coil be spaced?

A. 2. If bare wire is used, it must be spaced, but insulated wire may be wound as close together as possible.

Q. 3. What size wire is best for this purpose?

A. 3. About No. 22 or No. 24.

Q. 4. The longest I can make my aerial is fifty feet. How can I improve it?

A. 4. Where fifty feet is the extreme length possible for an aerial, the only way to increase its efficiency is by increasing the quality of the insulation on the ends of the wires, and also increasing the height, as well as the number of strands.

CHARGING STORAGE "B" BATTERIES

(83) Ross Sawyer, Brewster, N. Y., asks:

A. 1. Will the rectifier illustrated on page 155, Fig. 15, of the June issue of SCIENCE AND INVENTION, charge a 200-volt storage "B" battery?

A. 1. Yes. You will have to divide the battery into three groups and charge one group at a time.

Q. 2. How many lamps should be used in series with the rectifier?

A. 2. One 100-watt lamp in series with the AC line should give the required amount of current.

REASON FOR TAPPED "B" BATTERIES

(84) Chester W. Smith, Winslow, Ariz., inquires:

Q. 1. Why do most circuits show a 40- to 60-volt "B" battery with taps at 18 to 22½ volts.

A. 1. In order to operate amplifying tubes it is necessary to apply a potential of at least 45 volts to the plate, while detector tubes may be operated on from 18 to 22½. This is the reason that the circuits you mention are shown in that way.

Q. 2. What should be the capacity of a phone condenser?

A. 2. The fixed condenser across the phones should have a capacity of approximately .0125 M. F.

Q. 3. Can I use the same rheostat to control all my tubes?

A. 3. It is not usually desirable to use the same rheostat to control the filament potential of both the amplifying and detector tubes, and we therefore would advise you against it; a rheostat with a sufficiently large carrying capacity is necessary in any event.

TRANSMITTING WITH A RECEIVING SET

(85) H. K. Mayfield, Horse Cave, Ky., says:

My friend uses his receiving set for transmitting radiophone over short distances. He asks:

Q. 1. How can I do the same with my short wave regenerative receiver?

A. 1. Almost any type of regenerative receiver may be used as a radiophone transmitter over very short distances, by inserting the microphone, either in the grid or the ground leads, and causing the tube to oscillate. In doing so, however, we would advise that an amplifier tube be used instead of a detector tube, and that a very high voltage be applied to the plate of the same. This will aid materially in increasing the range.

Q. 2. What kind of a transmitter should I use?

A. 2. An ordinary telephone transmitter may be used for this work.

However, do not expect any great distance from this type of set, as it is a very inefficient form of transmitter.

LOOP AERIAL DATA

(86) Russell M. Ayres, Detroit, Mich., inquires:

Q. 1. What type and size of a loop aerial will give best results?

A. 1. It has been found that a very efficient loop aerial may consist of an ordinary square box about 2½ to 3 feet on a side, with sides about 6 inches wide. Instead of making this in the form of a box, it may be made by crossing two pieces of wood, and placing fibre or hard rubber strips at the ends.

Q. 2. How many turns of wire should be used?

A. 2. Wind this loop with 10 turns of stranded lamp cord, spacing the turns about half an inch. Provide a clip which has a suitable pin for making contact with the wire through the insulation, for one connection to the loop, and use one end of the wire for the other connection. Try different numbers of turns until the best results are obtained.

Q. 3. How does the loop compare with other types of antennas?

A. 3. A loop antenna when used in connection with an audion set employing one or two steps of radio frequency amplification and two or more of audio frequency amplification will give much greater selectivity than the outdoor type but will not allow reception over such great distances as the latter, nor as strong signals.

HONEYCOMB HOOK-UP

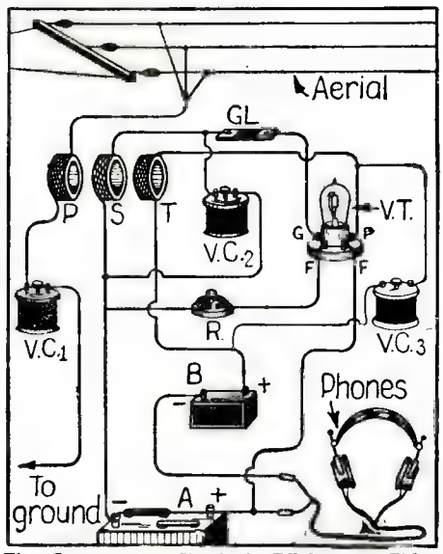
(87) L. W. Bluto, Germantown, N. Y., requests:

Q. 1. A hook-up for three honeycomb coils, three variable condensers, and an audion detector.

A. 1. We give herewith the circuit diagram as requested.

Q. 2. I am using a UV-201 as a detector. Will this give poorer or better results than a UV-200?

A. 2. We would say that you would undoubtedly get better results if you use a regular detector tube such as a UV-200 for detection, rather than an amplifier tube.



This Regenerative Circuit is Efficient on Either Short or Long Waves, the Only Changes Necessary Being in the Sizes of the Honeycomb Coils Used.

SHORTEST WAVE-LENGTH

(88) Fred Higby, Boise, Idaho, asks:

Q. 1. What is the length of the shortest electromagnetic wave than can be produced by a Hertzian oscillator?

A. 1. With a small dumb-bell type oscillator, waves as short as a fraction of a meter have been produced. With audions, still greater limits have been obtained, and waves as short as one-tenth of a meter have been produced. Uses for very short waves were described in a recent article in this journal under the heading "Marconi Explains Directional Radio."

USING INDOOR AERIAL

(89) J. G. Bass, Danville, Va., wants to know:

Q. 1. Can the outfit described on page No. 157 of the June issue of SCIENCE AND INVENTION be used with an indoor aerial?

A. 1. This could be done, but the results obtained would not be nearly as good as those obtained when using an outdoor aerial.

Q. 2. What size variable condenser should be used in this circuit?

A. 2. Condensers with a capacity of .001 M. F. should be used.

Q. 3. Can audio-frequency amplification be added to this circuit, and, if so, how?

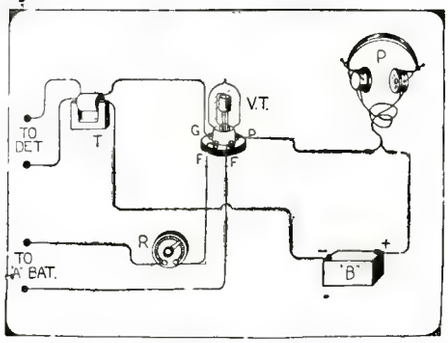
A. 3. Yes. See answer to Q. 90.

ONE-STEP CIRCUIT

(90) E. W. Bunselmeier, Cincinnati, Ohio, requests:

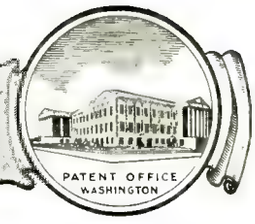
Q. 1. A good hook-up for making an audion detector set into a detector and one-step amplifier set.

A. 1. We give herewith the circuit diagram as requested.



One Step of Audio Frequency Amplification May be Easily Added to a Set Employing Only One Tube, by Using This Diagram.

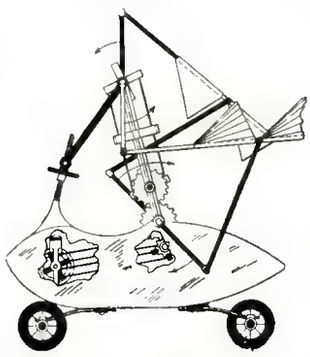
LATEST PATENTS



Flying Machine

(No. 1,426,870, issued to Gustaf Heden)

We certainly wish the inventor of this device plenty of luck with his



patent, as in our opinion he will have to be mighty fortunate in order to make his airplane operate. This airplane is of the flapping wing type, in which the wings themselves are caused to move up and down by means of a double cranklike arrangement. The wing frames caused to rotate and oscillate in a manner similar to the wings of a bird, are supposed to cause the wings to compress the air on the downward movement, and by means of the flexibility and looseness of their rear edges, they are able to evade the air on their upward movement. Steering the plane vertically is accomplished by increasing or decreasing the speed of the motors, while rudders guide it in the horizontal plane.

Thermo Relay

(No. 1,429,660, issued to Lawrence E. Warner)

A thermopile formed of a number of strips of different metals arranged in

series, so that the alternate junctures of the two metals are bunched together, is bent in horseshoe shape. These metal strips of iron and silver, or bismuth and antimony, are welded together. Surrounding one side of this horseshoe is a heating coil placed in series with the circuit going to an electric motor. This heating coil is surrounded with a jacket, so that the heat insulating qualities of the jacket enclosing the wire in the heating coil, correspond directly with the temperature of the hottest portion of the motor. Current generated by this thermopile actuates a relay, which will turn off the current to the motor by means of a circuit breaker whenever the motor becomes too hot.

Advertising Curtain for Theaters

(No. 1,429,802, issued to Charles F. Thompson)

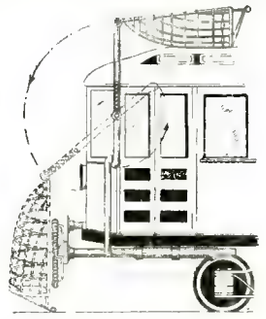
In theaters the curtain is often used for displaying advertisements, but no effort is made to make this curtain

more attractive. By substituting transparent material in back of signs along the walks, etc., and illuminating the curtain from the background, the inventor of this system produces the effect of day and night lighting effects. The translucent or transparent material is glued to the curtain and the sign painted thereon. Whenever it is desired to change the advertisement, the piece of translucent material may be removed, and subsequently replaced with the new sign.

Automatic Life and Limb Saver for Vehicles

(No. 1,376,200, issued to William S. Gregory)

Attached to the front of a vehicle are a pair of spring buffers with rising extensions on each. These extensions communicate with another swinging arm connected to a cage-like device, resting on top of the car. Should someone get in the path of a rapidly moving vehicle, the inventor believes that the spring buffers will be forced backward slightly, causing the swinging extension connected to the cage to tip, the balls therein contained will assist it in its rapid downward movement, and the victim will be caught on the cushion seat to be held there until

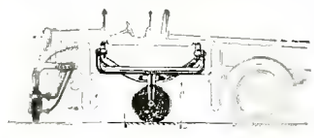


the car is stopped and moved backward a short distance, whereupon he is deposited upon the road. This limb saver would be very fine if its action were rapid enough, and accidents occurring followed a set rule. If a glancing blow were given a passerby, we are of the opinion that the limb saver would tend to injure the individual rather than protect him.

Turning Device for Motor Vehicles

(No. 1,430,545, issued to Edward C. Gledhill)

In order to turn a vehicle around sharply, the inventor employs a wheel

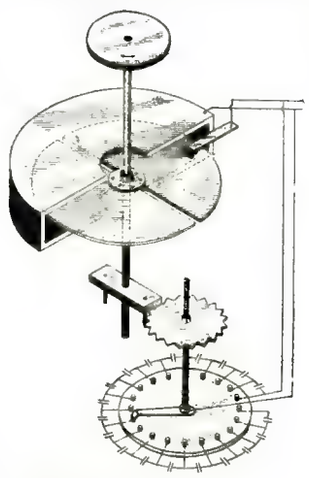


which is placed at right angles to the pneumatic tired wheels of the car, and arranged so that it may be swung down just in front of these wheels. A bracket is riveted or bolted to the chassis to hold the wheel first mentioned, and a catch connected to the filler tube of the radiator, prevents accidental release of the device. Inasmuch as the distance from the wheel to the chassis is greater than the distance from the pneumatic tires to the chassis it becomes obvious that when this wheel is moved down, it comes to a position a short distance in front of the machine. Consequently by driving the vehicle forward, it will be elevated slightly, at least to the extent of making the forward wheels leave the road. This ground wheel may be rotated by hand or by means of the vehicle motor itself, permitting the truck to turn through a relatively short arc.

Variable Condenser

(No. 1,429,227, issued to William Dubilier)

Fixed variable condensers which have been considered by many to be



superior to regular condensers, possess the disadvantage of delicate adjustments. In order to overcome this, the well-known condenser expert has combined a variable condenser with a fixed condenser in such a manner that the condensers of varying capacities are progressively connected into the circuit, in parallel with a single moving variable vane. It is quite obvious that with this arrangement, the capacity of the condenser can be carefully regulated and the maximum capacity could be much greater than in modern variable condensers.

Method of Cleaning Gold and Silver

(No. 1,416,103, issued to Wilber W. Everts)

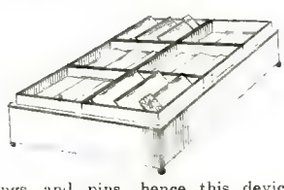
In the bottom of a receptacle is placed a plate made of an alloy of zinc,

seventy-five per cent and copper twenty-five per cent, or made of two sheets of zinc and copper riveted together. A solution of ordinary salt is now poured into the receptacle, and the gold, silver, platinum and other articles, are placed therein so that they rest on the metal sheet. The salt solution will now be decomposed, and the chemicals liberated in this manner will destroy foreign matter on the surfaces of the articles to be cleaned, after which they are removed, rinsed, and dried.

Moving Display Apparatus for Jewelry

(No. 1,425,508, issued to Charles E. Chapman)

Jewelers have had difficulty in properly displaying precious stones in

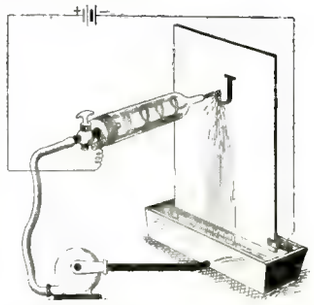


rings and pins, hence this device, which has a series of hinged platforms, periodically caused to swing upwardly, will prove of value. These platforms are actuated by levers, operated by cams, which cams are driven by an electric motor. Here and there on the tray displaying the jewels, one or the other of the platforms is tipped up slowly. Naturally, the lights playing on the jewels causes them to scintillate, and makes the tray much more attractive, calling attention to the individual bargains rather than to a mass of jewelry. While one group rises upward the remaining platforms remain horizontal.

Art of Electrolysis

(No. 1,416,929, issued to William E. Bailey)

This method of spot plating is very interesting. An electrolyte under pressure is forced toward the plate of opposite polarity. The hand tool through which the electrolyte is projected may be of an insulating material with an electrode therein to charge it from a battery. The depositing current is passed through the continuous jet from the anode to the cathode, and the metal itself is deposited in proximity to the point of contact of the jet with the plate. This cathode can be so inclined as to permit the surplus electrolyte to run off without plating, but if a sufficiently powerful jet is employed, this is not necessary. For instance, when the plating over a considerable surface of an article has worn off, or if a railroad line be engraved on a copper plate, and there is subsequently a

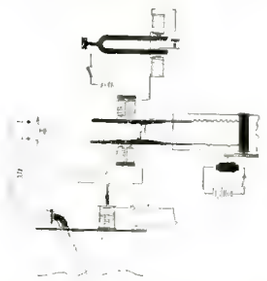


relocation of the line, it is very easy to either replate or fill in the engraved portion of the copper plate without removing it from its fastenings.

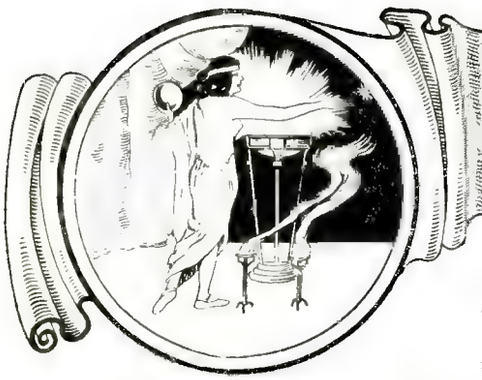
Sounding Apparatus

(No. 1,427,181, issued to Lester L. Westling)

This device will be found useful in nautical calculations An electro-



magnetic tuning fork of a known number of vibrations per second, operates a stylus, which constantly produces a record of the time interval on an endless band of paper driven by an electric motor. A solenoid operated by a key is caused to strike a diaphragm, which sound is immediately picked up by a transmitter actuating a second diaphragm, which in turn operates another stylus putting a mark upon the record. Reflected sound (from the bed of the river or ocean) is picked up by the same microphone, and another mark is put into the record. The strip of paper is now torn off and the time interval between the emission and the reflection of the sound carefully noted by comparing with the tuning fork record.



THE ORACLE

The "Oracle" is for the sole benefit of all scientific experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

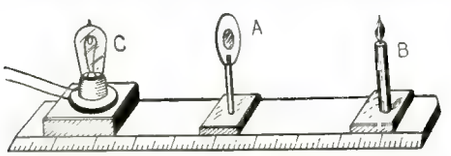
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of **25 cents** is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

MEASURING CANDLEPOWER

(1351) Herman Miller, Richmond Hill, N. Y., asks:

Q. 1. How may I measure the candlepower of small electric lamps?

A. 1. This may be done approximately by a simple apparatus known as the photometer, illustrated in the accompanying diagram. The electric light is mounted on a stand and placed on one end of a graduated board. Next, a small paper screen, also mounted on a stand, is placed somewhere near the center of the board, and on the other side of this is placed a standard candle. This is a sperm candle of the size known as "sixes," and burns at the rate of 120 grains per hour. In the center of the paper screen is a translucent spot made by applying a little hot paraffin thereto. This apparatus is now placed in a dark room and both the electric light and the candle lighted. Now adjust the positions of A and B until the translucent spot may not be seen from either side, or, in other words, until both sides of the screen look alike. Then, the intensity of the electric light is to the intensity of the candle as the distance from the electric light to the screen, squared, is to the distance from the screen to the candle squared. In other words, C is to B as AC^{-2} is to AB^{-2}. Solve for C and the result will be the candlepower of the electric light.



We show herewith how to measure the candlepower of an electric light. Complete instructions are given in the text.

HOT AIR ENGINE

(1352) L. W. Mulney, Newburyport, Mass., submits a sketch of a hot air engine consisting of a cylinder in the bottom of which a resistance coil is mounted, which heats up when current is passed through it. A piston is provided which fits the cylinder snugly. The device is supposed to work as follows: When the current is turned on the air in the cylinder heats and expands, thereby forcing the piston up. When the current is turned off the air cools, and the piston returns to this original position. He has tried this experiment, but cannot make it work. The piston ascends but does not return quickly. He asks:

Q. 1. Why does not the piston return to its original position and how can I make it do so?

A. 1. The hot air engine of which you speak is by no means new, and it will work if properly constructed. However, you have no means of cooling the cylinder and for this reason it will take quite some time for the piston to return. Your motor would probably work if you arrange some sort of a cooling system such as used in a water cooled automobile, so as to cool the air in the cylinder and the cylinder walls quickly.

ISINGLASS AND MICA

(1353) Chas. C. Bonham, Baltimore, Md., asks:

Q. 1. How is sheet isinglass manufactured from the isinglass or mica as found in nature?

A. 1. The name isinglass is very often applied to thin sheets of mica. This, however, is only a popular use of the name, inasmuch as true isinglass is, in reality, fish glue. It is a semi-transparent pure form of gelatin, and the true isinglass is prepared from the air bladders of various species of sturgeon. It is used in making jellies, as a clarifier, etc.

What you probably mean in your letter is mica such as is used in the fronts of stoves. This is used in exactly the same form as it is found in Nature. Mica is mined in large blocks from which these thin sheets are split.

NICKEL PLATING WITHOUT ELECTRICITY

(1354) A. Keidam, New York City, requests:

Q. 1. Can you give me a way to nickel plate, using nickel nitrate in the solution?

A. 1. We give herewith a simple way to nickel plate small objects, using nickel nitrate. This method does not require the use of an electric current.

Boil in a copper vessel a saturated solution of zinc chloride, and an equal quantity of water. While boiling add hydrochloric acid, a drop at a time, until the precipitate, which is first formed, is redissolved. Now add powdered zinc until the bottom of the kettle is nearly covered with a precipitate of zinc. A sufficient quantity of nickel nitrate is now added until the bath is of a strong green color. The articles to be plated are now hung in the bath by means of a zinc wire, or a strip of zinc, and a few pieces of the latter are also thrown in the bath. Raise the heat to the boiling point, and allow to boil for several minutes, or until the articles are covered with a bright coating of nickel.

It is always to be remembered that the articles to be plated must be thoroughly cleansed, and free from grease before being put into the plating solution. When the plating is finished, rinse thoroughly in warm water, and polish with precipitated chalk.

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers only with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in receiving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

.....

To..... Newsdealer

Address .....

Please reserve for me.....copies of SCIENCE & INVENTION every month until I notify you otherwise, and greatly oblige,

Name .....

Address .....

INVISIBLE INKS

(1355) M. R. Schoff, North Stratford, N. H., requests:

Q. 1. A formula for making invisible ink.

A. 1. What you probably refer to is the so-called sympathetic inks which, when used for writing, are invisible, but when heated or developed the writing appears. There are many formulæ for this work, and we are giving you several herewith. The method for bringing out the writing is also given.

Cobalt chloride, heat.
Cobalt acetate and a little saltpeter, heat.
Copper sulphate and ammonium chloride, heat.
Silver nitrate, sunlight.
Starch water, exposure to iodin vapors.
Cobalt nitrate, treatment with oxalic acid.
Dilute sulphuric acid, heat.

Another good method is to write with a solution of paraffin in benzol. When the solvent has evaporated, the paraffin is invisible, but becomes visible on being dusted with lamp black or powdered graphite, or by smoking over a candle flame.

FALLING BODIES IN SPACE

(1356) R. E. Thorn, Oshkosh, Wis., says: I read in an encyclopedia that a ball of iron and a ball of cork of the same size, if let fall from the same height at the same time, will reach the ground at the same time.

Q. 1. Does this mean any height, or does it mean a certain number of feet that they will fall together in the same time?

A. 1. Neglecting air resistance, both bodies would reach the ground at the same time. However, in the open air the ball of iron would land first. If these two bodies were dropped in a vacuum they would both hit at the same time. In other words, two bodies falling in an evacuated space, whether they are a ball of iron and a feather, or a ball of iron and a ball of cork, will land at exactly the same time, whether the distance of the drop be one foot or several hundred miles.

PHONOGRAPH RECORDS

(1357) A. G. Edison, Cleveland, Ohio, says: It seems to me almost impossible to record sound directly on a hard Ambrol record such as used in certain types of phonographs. He asks:

Q. 1. Is the sound directly impressed on these records?

A. 1. The usual method for making phonograph records is to record the voice on a soft disc, coat this record with powdered graphite, or some other electrical conducting compound and make an electrotype of the face of it. This electrotype is made quite heavy, and on this the records for retail use are formed from a soft composition, the electrotype being used as a die to stamp out the record. Of course, many other steps occur in the process, which because of a lack of space are not given here. In this way they are able to use the hard Ambrol, which in itself would not take the impressions directly from the recorder.

LEATHER BELT PRESERVATIVE

(1358) Jos. De Paolis, Geneva, N. Y., requests:

Q. 1. Can you give me a formula for a preservative for leather belts?

A. 1. In a well-covered iron vessel place one part by weight of caoutchouc, cut in small pieces, with one part by weight of rectified turpentine. Heat this to a temperature of about 152° F. When the caoutchouc is softened or dissolved, add .8 parts of colophony, stir until this is dissolved and add to the mixture .1 part of yellow wax. Into another vessel of suitable size pour three parts of fish oil, add one part of tallow, and heat the mixture until the tallow is melted; then add the contents of the first mixture. When this mixture is cool it will congeal. This grease is to be rubbed on the inside of the belts from time to time while they are in use. The belts will run easily and will not slip.

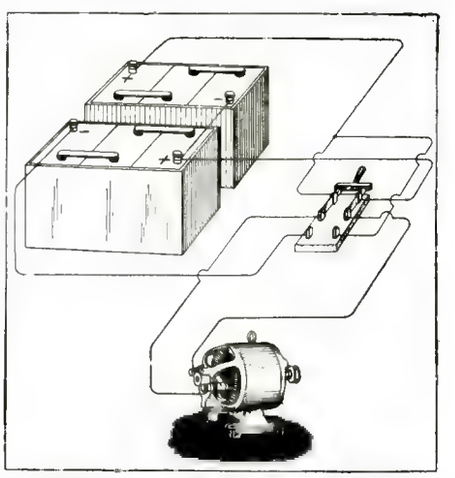
A simple way to make a belt pull, is to hold a piece of tar soap on the inside of the belt while it is running.

CHANGE-OVER BATTERY SWITCH

(1359) W. G. Elledge, Brinkley, Ark., requests:

Q. 1. A diagram showing how to connect two storage batteries to a motor through a double pole, double throw switch, so that the batteries may be used either in series or one alone by changing over the switch.

A. 1. We give herewith the diagram as requested.



This diagram shows how to connect a switch, so that either one storage battery alone or the two batteries in series may be used for running a motor.

THERMOSTATIC SWITCH

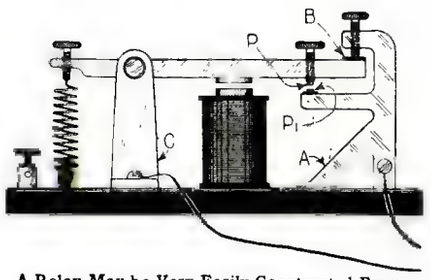
(1360) Waldo Williams, Alberta, Canada, asks:

Q. 1. Could I make a heavy arm of two thermostatic metals, which will release a switch which is closed by a spring when the current from one No. 6 dry cell passes through the thermostatic arm, same to return instantaneously?

A. 1. It would be impossible for you to construct a thermostat as you suggest, to release a switch when the current from a single No. 6 dry cell is passed through it, which will return in a fraction of a second.

If you wish to release this switch with the use of this current, why not employ a relay? These can be purchased from any up-to-date supply store, or may be very easily made by yourself. A relay may be very simply made from an old telegraph sounder. All that is necessary to do is to exercise a little ingenuity in placing and adjusting the contact points.

We are giving a sketch of a suggestion for this herewith.



A Relay May be Very Easily Constructed From a Telegraph Sounder by Placing Thereon an Insulating Strip B, and Two Contact Points P and P_1. Connections Are Then Made to the Standards C and A.

THE OCEAN'S TIDES

(1361) Thos. C. Moffet, Opal, Colo., says: Regarding the ocean's tides and their causes, I believe the generally accepted opinion is that the moon's gravitational attraction is responsible for them. It appears reasonable to me that they could be caused by another agent, namely centrifugal force. This force is, of course, present at the earth's surface, because of the rotation of the earth. It is my understanding that the tides occur periodically, and at the same time each day. If this is true——

Q. 1. How can they be caused by the moon which lags behind the earth some 50 minutes a day?

A. 1. We note that you say that it is your understanding that the tides occur periodically and at the same time each day. This, however, is not true by any means. The tides do not occur at the same time each day, but 51 minutes later each day at the same place. It will also be found that the moon comes to the meridian 51 minutes later each day. This fact alone is enough to show a connection between the moon and the tides. The sun also has a part in producing tides on the earth. It has been found that the tide-raising force is inversely proportional to the cube of the distance of the tide-raising body, and directly proportional to its mass. The sun is far more massive than the moon, but it is also much further away from the earth, and as can be shown, the solar tidal influence is only two-fifths as great as the lunar influence.

There are many circumstances of the tides that show that they are due to the attraction of the sun and moon. Lunar tides are highest when the moon is near the earth, and solar tides are highest when the earth is near the sun. Also, when the sun and moon are acting in conjunction at times of new and full moon, the tides are much higher than when the sun and moon are 90° apart at first and last quarter.

High tides occur at intervals of nearly thirteen hours, because a tidal crest is formed diametrically opposite the moon as well as directly under it, owing to the difference in the distance of the various particles of the earth's fluid and solid surfaces from the moon, and the resulting difference in the attraction of the moon for them. The waters directly under the moon are pulled away from the surface beneath, and the earth is pulled away from the more distant fluid surface. This produces two tidal crests, one directly under the moon, and the other diametrically opposite. As the earth turns on its axis these two tidal crests about 12 hours and 51 minutes apart travel over the earth following the moon.

Continental barriers and variations in the contour of the coast lines complicate the motions of the tides. In the mid-Pacific Ocean the rise and fall of the tides is very slight. Tides in the Atlantic are propagated by a tidal wave coming from the Pacific and Indian Oceans around the Cape of Good Hope. The tides in the North Atlantic are far more complicated than the tides of the Pacific. The time that elapses from the passage of the moon over the meridian to the next following high tide depends on the location of the port. The height of the tides at any port depends on the form of the coast line at that point and the depth of the water. The highest tides occur where the water is, as we may say, forced into a corner, as in funnel-shaped bays. The highest tides in the world occur in the Bay of Fundy on the coast of Nova Scotia where the outline of the coast is such as to force the waters to a high level.

Isabel M. Lewis, in her reply to this inquiry, concludes: The tidal problem is an exceedingly complicated one, owing to the irregularities of the earth's surface and the varying depths of the ocean but there is little doubt that the tides are due to the gravitational attraction of the sun and moon for particles of the earth's surface.

PRESSURE IN GASOLINE TANK

(1362) Howard W. Reid, North Charleston, So. Carolina, asks:

Q. 1. If air is compressed to 100 pounds' pressure in a gasoline fuel tank, could it possibly result in internal combustion?

A. 1. If you compress air into a gasoline tank to a pressure of 100 pounds, internal combustion cannot result, unless some igniting agent, such as a spark, is used. The pressure itself might ignite the gasoline and air mixture, if it was produced quickly enough.

COMPRESSING WATER

(1363) Stanley Wilson, Guelph, Ont., Canada, wants to know:

Q. 1. Can water be compressed, and if so, how much for a certain pressure?

A. 1. Water is compressible but to a very slight degree, almost infinitesimally. Thus when water is compressed to about 2,500 pounds, per square inch, its effect is just noticeable. Such pressures are only found in nature at a depth of 6,000 feet or more below the surface of the ocean. Its compressibility is from 0.000040 to 0.000051 for one atmosphere. At a depth of a mile the weight of a cubic foot of water is about half a pound more than at the surface.

QUERY ON THE FOURTH DIMENSION

(1364) Watkin Davies, Stockton, Calif., says:

In reading an article in your magazine on the Fourth Dimension, I noted that the author says that when a brick is hurled through space at a speed of 175,000 miles an hour, it will contract sufficiently to almost form a cube. He asks:

Q. 1. If the brick were to travel at the rate of 186,000 miles per second, would not the brick be formed into a sphere, which I believe is the shape of all heavenly bodies?

A. 1. A brick flying through space at a speed of 186,000 miles per second or the speed of light, does not become a heavenly body. It does not rotate, and assuming that there is no friction, etc., there is absolutely no reason for it becoming spherical.

Q. 2. Is it true that when a ball is thrown into the air, the earth goes up to meet the ball?

A. 2. This fact is true, and the earth does rise to meet the ball, but it rises in inverse proportion to its mass, compared to that of the ball. If the ball is thrown into the air, which ball we will assume weighs one pound, and it is thrown with a force sufficient to carry it to a height of one mile; inasmuch as the weight of the earth is 13,666,000,000,000,000,000,000,000 pounds, the movement of the earth toward that ball would be 0.000,000,000,000,000,000,000,046 of an inch. We will delegate you to measure this distance, although it could possibly be done with an instrument similar to the Michelson device, the principle of which was employed in measuring the diameter of Betelgeuse.

Articles in December "Practical Electrics"

Farm hydro-electric plant
X-Ray Treatment of cancer
Telelarm system
Indicating voltmeters and ammeters
Operating railroads by static electricity
New York fire alarm telegraph system
Automatic welding machine
Testing an experimental switchboard
Longer life for electrical devices

FIRE-PROOFING SOLUTIONS

(1365) Hans A. Zopff, St. Cloud, Minn., requests the following information:

Q. 1. Will you give me formulas for the fire-proofing of cloth and wood?

A. 1. To fire-proof cloth, immerse the article for about fifteen to twenty minutes in the following solution, which has been heated to 100° C.

Ammonia chloride	9 oz. av.
Boric acid	3 oz. av.
Borax	1 oz. av.
Water	48 oz. fluid

To fire-proof wood, apply several coats of the following:

Zinc oxide	20 oz. av.
Water	10 oz. fluid

To this add sodium silicate sufficient to make the solution take on the consistency of a thin paste. This makes a white application. By using yellow ocher instead of zinc oxide, a yellow color will be produced.

EXPANSION OF WATER WHEN TURNED TO STEAM

(1366) Fenwick C. Williams, Lowell, Mass., asks:

Q. 1. What would be the result of injecting a spray of water at a temperature slightly below the boiling point, into a volume of air highly heated by compression, in a suitable cylinder, one end of which is equipped with a piston? Would the steam thus generated develop sufficient pressure to drive the piston, or would the temperature be lowered enough to keep the pressure constant?

A. 1. In our opinion, injecting a spray of water into a highly heated volume of air under compression in a cylinder, would cause steam to be developed sufficient to move the piston. Incidentally, the temperature of the cylinder would be lowered, but the efficiency of the outfit is very slight. This suggestion has been made before, by inventors who are working along the lines of developing heat by friction and employing this heat to generate steam to drive the same piston. This, however cannot be done.

CLEANING SILVERWARE

(1367) Maurice G. Weinstein, Milwaukee, Wis., asks the Oracle:

Q. 1. Will you kindly give me a simple, cheap method which will effectually clean silverware, without necessitating the use of abrasives?

A. 1. If you will take two teaspoonfuls of ordinary baking soda and dissolve it in boiling water in an aluminum kettle, and place your silver in the solution, you will find that the latter will be cleaned admirably. Special cleaning pans for silver have been on the market based on the reaction involved in the above method.

SPRING MOTORS

(1368) W. S. Woods, Halifax, N. S., Canada, inquires:

Q. 1. Can you tell me where I can get a powerful clockwork motor, the spring to be cylindrical in shape, and no more than 2½ inches in diameter, when there is no tension on the same? I want this spring to be fairly flexible, and at the same time capable of being compressed to a very high tension.

A. 1. The nearest approach to what you desire would be a spring motor from an ordinary phonograph. There is no clockwork whose single spring is fairly flexible, and at the same time allows itself to be compressed to exert a great tension. Perhaps the spring effect found in phonograph motors will give you exactly what you want.

FREEZING MIXTURES

(1369) H. J. Leventhal, Mehase Park, Ill., requests:

Q. 1. Several chemical mixtures which will freeze water when placed in or around it.

A. 1. We give herewith a few freezing mixtures and their temperature depressions. In using freezing mixtures, it is advisable that the chemicals be in a finely powdered form. The vessels should have been previously cooled and cold water employed. After the chemicals have served their purpose, the water may be evaporated and they can be used again.

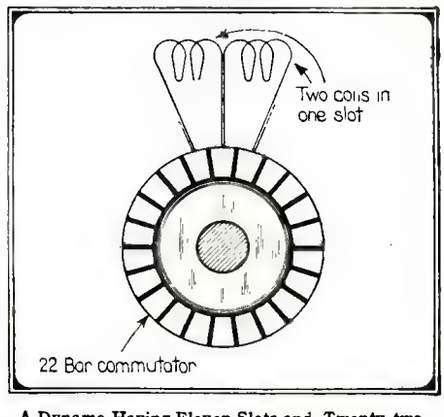
1. Ammonium chloride ..... 3 oz. av.
   Potassium nitrate ..... 1 oz. av.
   Potassium chloride ..... 6 oz. av.
   Water ..... 10 oz. fluid
   Temperature depression 30 degrees C.
2. Ammonium chloride ..... 3 oz. av.
   Potassium nitrate ..... 3 oz. av.
   Sodium sulphate (small crystals) 5 oz. av.
   Water ..... 11 oz. fluid
   Temperature depression 25 degrees C.
3. Ammonium nitrate (powdered) 10 oz. av.
   Water ..... 10 oz. fluid
   Temperature depression 30 degrees C.
4. Ammonium chloride ..... 2 oz. av.
   Potassium nitrate ..... 2 oz. av.
   Water ..... 6 oz. fluid
   Temperature depression from 10 to 12 degrees C.
5. Nitric acid ..... 2 oz. av.
   Water ..... 6 oz. av.
   Mix and allow to cool. When cold add sodium sulphate (crystal).
   Temperature depression 10 to 125 degrees C.

CONNECTIONS FOR GENERATOR

(1370) Gus Haüsler, New York City, asks the Oracle:

Q. 1. Can you give me a diagram showing how to wire a Splitdorf motorcycle battery-charging generator that has 11 slots, and 22 commutator bars, two layers or coils being wound in each slot.

A. 1. In winding a generator with 11 slots, and 22 commutator bars, there are two coils wound in each slot. These coils are connected in series, and the center point goes to one bar, and the two outside ends to bars on either side of the first one, as shown in the diagram given herewith.



A Dynamo Having Eleven Slots and Twenty-two Commutator Bars, Is Hooked Up as Shown Herewith. Two Coils Are Wound in Each Slot.

Which will you do?

Disappointment, Embarrassment, Replacement—
with the OLD TYPE *Batteries!*

WHAT *is* the chief cause of noisy radio reception? Why *should* you listen to squeaks and wheezes? Why *should* you get the poorest out of radio, when the best is *so* easy to get? Which will you do?

Quiet, crystal clear, wondrously melodious reception comes only where "B" batteries are *noiseless!* Mark *that—only where "B" batteries are noiseless.*

* * *

Noiselessness can be had *only* in *storage* "B" batteries. Now note *why* Radiobats "B" are the only storage batteries which you can use with *absolute* safety and unapproachable economy—and why you should use Radiobats, both "A" and "B", for the best reception possible to get.

Both "A" and "B" Radiobats are *dry storage* batteries. Their electrolyte is *non*-fluid. They can't spill acid—even when lying upside down, because they contain *no* liquid. They are *safe*.

They are practically unbreakable, because they contain no separators, no glass. There just *isn't* anything to break.

They are easily charged at home—and there is never any cost, except the low cost of charging, because the first cost *is* the last cost.

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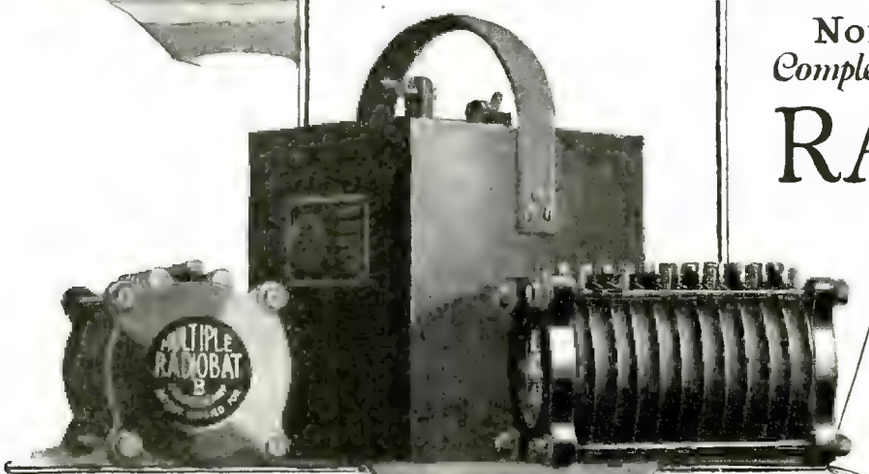

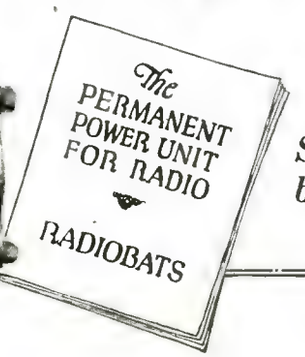

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Town .....State.....

Radio Broadcast Stations

(*Continued from page 775*)

Call Letter	Name	City	State	Wave Length
WFAP	Browns Business College. Weather, lectures, market reports, music, sermons, baseball scores, news bulletins, special features daily except Sundays, 10.30 A. M. 12.00 to 12.15, 1.45 to 1.55, 4.30 to 4.50 and 7.45 to 8.45. Sundays 3.30 P. M. Consistent range 150 miles. Maximum 550.	Peoria, Ill.		360
WFAT	The Daily Argus Leader. Lectures, music, sermons, baseball scores, special features. Mondays, Wednesdays, Fridays and Saturdays 7.30 to 8.00 P. M. Tuesdays and Thursdays 7.30 to 7.45, 8.00 to 8.45 P. M. Sundays 7.00 to 7.30 P. M. Central Standard Time. Consistent range 250 miles. Maximum 450.	Sioux Falls.	S. D.	360
WFAX	Arthur L. Kent. Weather, lectures, music, sermons, news bulletins, special features. Only transmit when big stations are inaudible, as a local affair. Consistent range 50 miles. Maximum 1600.	Binghamton,	N. Y.	360
WFI	Strawbridge & Clothier. Lectures, market reports, music, sermons, baseball scores, news bulletins, special features. Every day except Sundays 10.00 to 10.30, 1.15 to 1.30, 2.00 to 2.30, 3.30 to 4.30, 6.00 to 7.00 P. M. Sundays 4.00 to 5.00 P. M. Consistent range 200 miles. Maximum 1000.	Philadelphia,	Pa.	360–485
WFO	Rike Kumler Co. Weather, lectures, market reports, music, sermons, news bulletins daily 9.00 to 9.30, 11.05 to 11.30, 4.00 to 4.30 P. M., except Sundays. Mondays, Wednesdays, and Fridays, 8.00 to 9.30 P. M. Consistent range 150 miles. Maximum 300. Sundays 11.00 to to 12.00 M.	Dayton,	Ohio	360–485
WGAB	QRV Radio Co. Lectures, music, news bulletins, special features daily except Sunday 8.30 to 9.00 A. M., 1.00 to 2.00 P. M., 4.00 to 5.00 P. M. Tuesdays 9.15 to 10.00 P. M. Eastern Standard Time. Consistent range 560 miles. Maximum 1585.	Houston,	Tex.	360
WGAH	New Haven Electric Co. Weather, lectures, music, sermons, baseball scores, news bulletins daily except Sunday, 2.30 to 2.45, 3.30 to 3.45, and 4.30 to 4.45 P. M. Consistent range 300 miles.	New Haven,	Conn.	360
WGAL	Lancaster Elec. Supply & Const. Co. Weather, time signals, lectures, music, sermons, baseball scores, news bulletins. Consistent range 30 miles. Maximum 50.	Lancaster,	Pa.	360
WGAM	Orangeburg Radio Equipment Co. Weather, lectures, market reports, music, baseball scores, news bulletins, special features. Daily except Sunday 10.00 to 10.30 A. M., 6.00 to 7.00 P. M. Also on Tuesdays and Fridays 8.00 to 9.00 P. M. Consistent range 250 miles. Maximum 850.	Orangeburg,	S. C.	360
WGAQ	Glenwood Radio Corp. Lectures, music, sermons, baseball scores, news bulletins, special features, Mondays and Fridays 7.45 to 8.30 P. M., Tuesdays, Wednesdays and Thursdays, 7.45 to 9.00. Sundays 11.00 A. M. and 7.45 P. M. Consistent range 500 miles. Maximum 1400.	Shreveport,	La.	360
WGAS	The Ray-Di-Co Organization. Time Signals, Lectures, market reports, music, news bulletins, special features. Consistent range 500 miles. Maximum 1000.	Chicago,	Ill.	360
WGAZ	The South Bend Tribune. Lectures, music, sermons, news bulletins, special features daily except Sundays 9.00 A. M., 2.00 to 3.00, 7.00 to 8.00 P. M. Consistent range 200 miles. Maximum 500. Central Standard Time.	South Bend,	Ind.	360
WGF	The Register & Tribune. Lectures, music, sermons, special features. Special hours on Mondays, Wednesdays, Thursdays and Saturdays. Tuesdays and Fridays 7.30 P. M. Sundays 5.00 P. M. Consistent range 200 miles. Maximum 1500.	Des Moines,	Iowa.	360–485
WGI	American Radio & Research Corp. Weather, lectures, market reports, music, vocal and instrumental talent, sermons, baseball scores, news bulletins, special features. Daily except Sunday 10.00 A. M., 11.30, 1.30, 3.00, 3.15, Mondays, Tuesdays, Thursdays and Saturdays 6.00 to 9.00 P. M. Wednesdays and Fridays 9.00 to to 11.00 P. M. Sundays 7.45 P. M., 8.00 to 9.00 P. M. Consistent range 300 miles. Maximum 2500 miles.	Medford Hillside,	Mass.	360

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Give all inventors full opportunity to show the public, the manufacturer, the merchant, the capitalist and financier, the possibilities for utility, business, trade and commerce that lie in their inventions. Inventors whose devices may be adjudged to combine novelty and utility with commercial practicability will be awarded, by a qualified board, cash prizes, gold, silver and bronze medals and certificates of merit.

The exposition will be a veritable "Clearing House of Ideas" through which the man of originality and ideas is brought in personal contact with the man in need of ideas and with the man of money.

The Exposition of Inventions and Patents will be a place where anyone with an idea, formula, process, labor-saving plan, device, etc., improvement on machinery, new invention, a developed and patented specialty, or anything saleable can exhibit. This will enable the manufacturer who is looking for some sort of device which will lessen the labor and cost of producing his wares, which will assist in the economic production of raw material or its procuring, or will help to secure the economic manufacture of such raw material, or the capitalist who is searching for some clever device or process in which he can see the possibility of increasing some of his idle money—to see what the man of ideas has to offer.

The personnel of the exposition staff consists of men experienced in fostering and developing inventions. Some of the staff are engineers, business men and attorneys of international fame.

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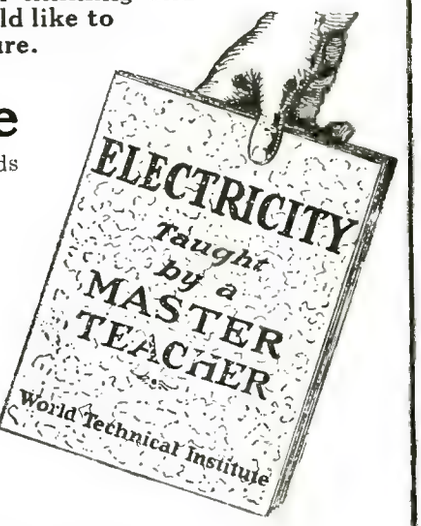

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You will be supplied with a real working outfit, consisting of a motor and over eighteen standard articles. Superior to the working outfit of any other school. It is yours to keep. No strings attached to it.

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We render a real employment service to students who wish to avail themselves of the same. We give real time and energy to placing students in satisfactory positions.

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You run no risk whatever in enrolling with us. The risk is all ours. We give you a Bond which guarantees satisfaction.

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Our great free electrical book, and all particulars in regard to the most remarkable offers ever made by any school will be mailed to you free and postpaid upon receipt of coupon.

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Absolutely Free. This 56-Page Book

This book, which cost $2,500 to produce, is yours for the asking. It will tell you hundreds of vital facts about the world of electricity which you should know. It also reveals the startling truths about the latest method of preparing men for big positions.

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Gentlemen:—Send to me postpaid, and without obligation, your valuable illustrated book entitled, "Electricity Taught by a Master Teacher," also full particulars in regard to your course and the remarkable offers you are making to students.

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"A dollar a minute"

"That's what I figure my spare-time study with the I. C. S. was worth to me. It was the best investment I ever made. I'm now making $160 a week—or almost twice as much in a single hour as I used to make in a whole day!"

Every mail brings letters from some of the two million students of the International Correspondence Schools telling of promotions and increases in salary as the rewards of spare-time study.

What are *you* doing with the hours after supper? Can you afford to let them slip by unimproved when you can easily make them mean so much? One hour a day spent with the I. C. S. will prepare you for the position you want in the work you like best. Yes, it will! Put it up to *us* to prove it. Mark and mail this coupon *now!*

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Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject *before* which I have marked an X:

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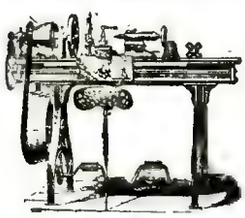
Persons residing in Canada should send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada.



LATHES

9 to 18-inch Swing

List price $150 and up according to size. When ready to buy send for Lathe Catalog and prices.

W. F. & John Barnes Co.
442 Ruby St., ROCKFORD, ILL.

SELL US YOUR SPARE TIME

Earn $15 to $50 Weekly at home

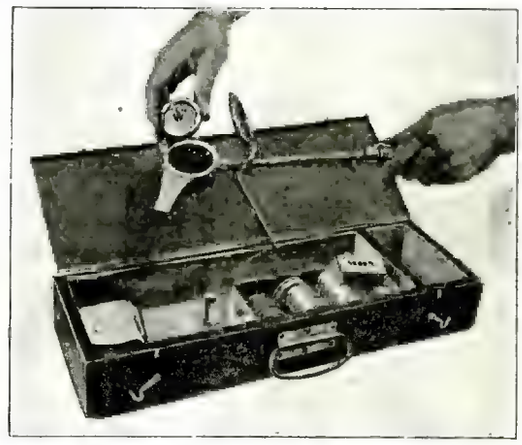
No experience necessary writing show cards for us. We instruct by correspondence. Work and supplies furnished.
SHO-RITE SIGN SYSTEM, Inc.
Desk 99 Detroit, Mich.

Briquette Soldering Iron

This new soldering iron employs no heat from an outside source but utilizes chemical reaction to heat the tip. A comparatively recent invention produces, by chemical transformation, a degree of heat of approximately 300° C. in a few seconds.

It is now possible with an exactly measured quantity of a reacting mixture, to heat a soldering iron, or a sad iron, in seven seconds to a point where it is ready for immediate use.

This soldering iron has a receptacle cast in it. In this is placed a small tin container holding the required mixture. The head of a special match is inserted through an opening in this container, or briquette, and the wooden portion broken off. A perforated lid is then closed over the receptacle and the protruding match-end lighted. Instantly an intense white glow appears through the holes in the lid and the iron is ready for use. The heat from this one application lasts about ten minutes, after which another charge can be immediately lighted and the operation continued. After the first heating, the duration of heat under one charge is increased fifty per cent.



Place a Briquette In This Soldering Iron, Light It With a Match, and in a Few Minutes the Iron Is Hot and Ready For Use. A Fine Tool For Out-Door Work—Wind Does Not Bother It.

As prepared for the trade, the iron and a supply of the briquettes and matches are housed in a compact, metal lined box, with hinged lid and handle for carrying. So convenient is this arrangement that the charge can be set off in the box in the house, barn, office or living room, with no danger from sparks, and no more smoke than a whiff from a pipe. While in use there is no flame—nothing but a glowing mass within the receptacle. This outfit is particularly handy for the householder or the mechanic who has quick repairs to make. Owing to the absence of the fire hazard it may be used about the garage, barn, shop or house or on the airplane, automobile, or motor boat, with entire safety.

Advice How to Use Coal

There is timely information for the householder in a circular issued by the Navy Department on the economical use of anthracite in furnaces and stoves.

Referring to the manner in which anthracite fires should be handled and pointing out the advantages of using the smaller and cheaper sizes, the circular says:

"At night, after the fire is shaken down and some of the large coal put on, the fire can be banked for the night by shoveling on a top dressing of No. 1 buckwheat. This top dressing tends to hold down the draft and aids in the proper combustion of the coal body as a whole.

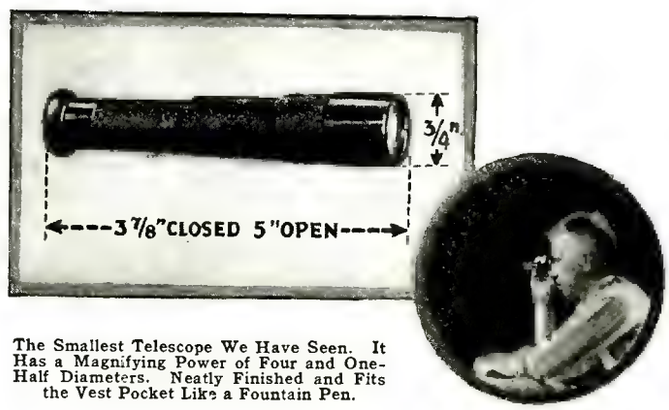
"In the morning, at least in mild weather, the furnace should be shaken down as usual and fired with some of the regular coal. After the fire has begun burning well it can be checked or banked by using a quantity of the fine coal as top dressing.

"The two sizes of coal never should be mixed, but should be kept in separate bins. The buckwheat should be used only as a top dressing, and should not be used except with the larger sizes of anthracite. "The ordinary furnace does not have sufficient draft to produce satisfactory results when buckwheat is used with either chestnut or pea coal.

"If you have a good bed of fire put the egg coal on first and then add a smaller amount of pea coal."

Smallest Telescope

The accompanying photos show the world's smallest practical telescope, or at least the smallest one regularly manufactured, and that we know of. It measures 3⅞ inches in length closed, and 5 inches in length extended. It has a magnifying power of 4½ diameters, and the objective lens is ⅝ of an inch in diameter. The objective lens is a concavo-convex flint with double convex crown. The eye piece is double-concave flint. The tube is brass throughout, finished with black crystallized lacquer. The little telescope is furnished in a suede leather case. This little instrument will find many friends among Boy Scouts, travelers, and in fact people everywhere, as it places a remarkably well-built optical instrument of considerable magnifying power in one's hands at a nominal price. This small telescope will find many other uses also; for example it may be used as a finder or spotting telescope for larger instruments when mounted on the side of the barrel of the latter. By mounting two of these small telescopes together with a clamp, an improvised field glass is had.



The Smallest Telescope We Have Seen. It Has a Magnifying Power of Four and One-Half Diameters. Neatly Finished and Fits the Vest Pocket Like a Fountain Pen.

NOW $6.50

Hear it Loud and Clear-Toned!—

THE most expensive set—the best circuit, the newest apparatus carefully tuned, will not give maximum results unless your receivers are good. "Red-Heads" in the seven years they've been on the market have met every critical test of Radio. Designed by radio engineers. They are sensitive. They are accurately made. They are durable and will hold their sensitiveness.

At the new low price of $6.50 they are without a doubt today's biggest value in high-grade Radio Receivers. You take no risk when you buy "Red Heads". Send the coupon today—

3000 ohms Complete with military head-band and cord.

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Newman-Stern Building **CLEVELAND, OHIO**

Also producers of "NAA" Arlington Tested Detector Crystals and Teagle Line of better radio apparatus. Send for descriptive bulletins.

At your dealer's or sent direct on receipt of price.
THE NEWMAN-STERN CO., Cleveland, O.

Gentlemen:—Enclosed is Money Order for $6.50 for which please send me a pair of "Read-Head" Receivers. It is understood that if I am not completely satisfied with these 'phones, I may return them within seven days and get my money back.

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Your Radio Catalogue Ready for You—FREE

A POSTAL card will put this complete, illustrated catalogue promptly into your hands—free! Over eighty pages of interesting and helpful radio information, right up to date.

The apparatus pictured and described is the newest. The prices quoted will appeal to the experienced and economical buyer.

Everything in the book is presented with clearness and simplicity, so it is easy to look up what you're interested in, easy to grasp the facts about it, easy to send for it if it's what you need.

Just drop us a card for catalogue E-6 and you'll soon possess this valuable little radio handbook.

The Newman-Stern Co

Cleveland, Ohio

Watch for This Name —It's Your Guarantee

HERE'S a safe tip—radio apparatus that bears the name "Teagle" is *good*. You can be sure of the engineering skill behind it—for six radio engineers designed every instrument in the Teagle line. You can be sure of the quality of workmanship—for every device made in the Teagle Division of The Newman-Stern Co. is carefully supervised during its manufacture.

There are now eight little masterpieces bearing the Teagle name, every one of them a *better* instrument of its kind: The Teagle Filament Rheostat, the Teagle Vacuum Tube Socket, the Teagle 'Phone or Stopping Condenser, the Teagle Grid Condenser, the Teagle Moisture-proof Variable Grid Leak, the Teagle Adaptafone (for converting the sound chamber of any phonograph into a loud speaker), the Teagle Crystal Detector, and the Teagle Crystal Receiving Set.

Teagle MADE IN U.S.A.

Send for illustrated circular on Teagle instruments; learn the details of their construction, and how moderately they are priced.

The Newman-Stern Co

Cleveland, Ohio

Use "NAA" Arlington Tested Minerals

—the original *tested* crystals

THESE famous tested Detector Crystals have won their reputation through sheer goodness—through their marvelous and uniform sensitiveness—by the honesty with which they are tested, packed and guaranteed.

We sell *sensitiveness*, not *bulk* minerals. Pounds of crystals are worth little—ordinary Galena, for instance, is cheap—the market price is less than 3 cents a pound. For crystals worthy of efficient radio use, insist upon the genuine "NAA" (Arlington Tested) Detector Crystals. For your own protection look for the signature of J. S. Newman, the originator, on every container. It means *guaranteed sensitiveness.*

"NAA" Galena, Silicon or Goldite, price per crystal, postpaid, $0.25. Mounted, set in Wood's metal in brass cup, price per crystal, postpaid, $0.40. At your dealer's, or sent direct on receipt of price.

The Newman-Stern Co

Cleveland, Ohio

The Experimenter's Delight

THE N-S Microphone Button has become one of the most popular little experimental devices obtainable. The number of curious and interesting things you can do with it is endless. It may be used as a replacement unit for worn-out telephone transmitters. By properly connecting the button, speech, phonograph records and music may be transmitted to a distant place. It serves admirably as a detectophone, enabling you to overhear what is being said and done quite a distance away.

(Full Size)

It also makes an ideal modulation microphone for radio telephone use, and is likewise available for amplifying radio signals. The various fascinating uses for the N-S Button are too numerous to mention, and clever experimenters are constantly discovering new uses. You get a big value in the way of intensely interesting experimentation when you purchase this button for $1.00.

$1.00 PREPAID ANYWHERE ON RECEIPT OF PRICE

The Newman-Stern Co

Cleveland, Ohio

FREE-This Book on Home Beautifying

S.C JOHNSON & SON,
"The Wood Finishing Authorities"
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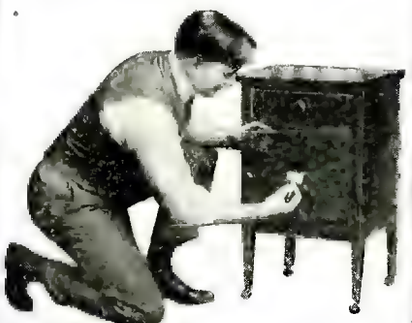
THIS book tells how to finish wood in artistic stained and enameled effects. Gives practical suggestions on making your home artistic, cheery and inviting. Tells just what materials to use and how to apply them. Includes color card—gives covering capacities, etc. Use coupon below.

JOHNSON'S WOOD DYE

With Johnson's Wood Dye inexpensive soft woods, such as pine, cypress, fir, etc., may be finished so they are as beautiful and artistic as hardwood.

Johnson's Wood Dye is very easy to apply—it goes on easily and quickly, without a lap or a streak. It penetrates deeply, bringing out the beauty of the grain without raising it—dries in 4 hours and does not rub off or smudge.

Full instructions for finishing all wood—old or new, soft or hard, are given in the booklet.



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Please send me free and postpaid your Instruction Book on Home Beautifying and Wood Finishing.

The best dealer in paints here is.....

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MY NAME .....

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Money in Ashes and Sawdust

By WILLIAM R. REINICKE

EVEN the ashes, for whose removal we have been paying many millions of dollars, now have a value. Dr. Christian Jaeger has discovered a process by which he can mix sawdust and ashes, and then, by means of dies and heat, reproduce the most artistic boxes and articles in daily use.

A certain quantity each of sawdust and ashes and a few chemical ingredients are placed in a mechanical mixer and thoroughly mixed. The quantity required for the manufacture of the particular article is then placed in the container and taken to the die presses where the material in the dies is placed under a pressure of eight hundred pounds for three minutes, the dies being heated by gas.

Each machine makes six pieces at a time, more or less, according to the size of the die, one man taking care of two machines.

The entire manufacturing method is one of almost unbelievable simplicity. Most of the articles can be made in a single operation; in other words, can be produced in any shape, by a single pressure. A box made by the carpenter is generally composed of six pieces, but these boxes only have two pieces, top and bottom.

Articles made of this combination are about as light as cardboard, and are exceedingly strong.

After coming from the dies, the rough edges are ground off upon emery wheels. Some are used in this condition, giving them the appearance of beautiful seasoned oak, showing dark spots here and there upon the surface, reminding one of the grain of a solid piece of wood. This mottling is no doubt caused by the heat being greater upon some portions of the surface, while in the dies, than in other parts. Instead of being a detriment, it adds greatly to the beauty of the articles. As the dies can be made to stamp, or mold, as one could really call it, any design, including as many handsome pieces as desired, are produced. There are no uneven lines as we often find in the case of embossed cardboard boxes.

Where it is desired to color the articles, an air brush is used, and an operator can color two thousand boxes a day. Some unique color combinations are made, and the treatments applied, some of them also invented by Dr. Jaeger, give the articles the appearance of ivory or celluloid.

Recently the manufacturers have been experimenting with a substitute for ashes, and have found a substance which gives better results, but even with the increased cost of this new substance they can produce articles greatly below the cost of similar fancy articles produced from wood or cardboard.

There seems to be no limit to the variety of articles which can be manufactured from this combination: candy boxes, calendar stands, flower boxes, vanity boxes, spools for silk mills, razor boxes, advertising signs, cigar boxes, memo files, picture frames, etc.

28-Hour Mail Between New York and 'Frisco

An air mail service of twenty-eight hours between New York and San Francisco within a year was promised recently by Paul Henderson, Second Assistant Postmaster General, in a talk at a luncheon given in the Automobile Club of America by the Aeronautical Chamber of Commerce.

The coast-to-coast service would be made possible by an all-night flight between Chicago and Cheyenne, Wyo., a distance of a little more than 1,000 miles. Airplanes carrying 800 pounds or more of San Francisco mail sorted and ready for the carrier, for example, would leave New York early one morning and deliver on the Pacific Coast the next day, Mr. Henderson explained. He also told his hearers that contracts had been let for the illumination of the air-mail field at Chicago. If satisfactory arrangements were completed at Detroit, he said, the first night postal flights probably would be made between Chicago and Detroit early next month.

Mr. Henderson also announced that air mail to the interior of Alaska soon would be in operation. He said that the Post Office Department now expends $185,000 a year for inland Alaskan service, dog teams being chiefly used in transporting the mail. Two investigators were now in Alaska mapping out air routes, he added, and he believed the airplane would be cheaper than the present modes of transportation in Alaska.

Mr. Henderson's subject was "Night Flying." He said the Postal Air Mail had been at work on this phase for several months, in co-operation with illuminating research corporations. A system of lighting had been devised which assured a safe night way from coast to coast, with the pilot at no time out of sight of powerful beacons casting beams of forty miles in length. The illumination of the Chicago field will follow as nearly as possible "daylight perspective." The buildings will be flood lighted and the field will be outlined with light, red lights marking the landing spots.

Radio Concert in Newark Heard in London

The attempt of L. Bamberger & Co., a Newark department store, to play a radio program for a London audience recently succeeded in part. A great deal of interference from ships strung out along the more than 3,000-miles ocean path of the wirelessed words was reported.

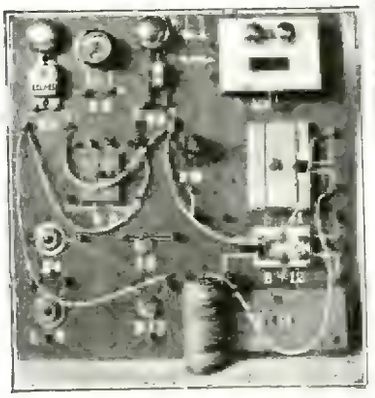
Employing only the regular equipment of station "WOR," located on top of the store building in Newark, the experimenters picked 12.45 o'clock one morning recently as a suitable time to try to speak in Newark and to be heard in Selfridge's big department store in Oxford Street, between Regent Street and Marble Arch, London.

The first number sent out into the ether was a snatch of song by a woman singer. Then the orchestral music was dispatched and finally Sir Thomas Lipton, who had been invited to go to the Newark store from a dinner to Argentine and New York police officials in Manhattan, started his speech into the transmitting mechanism. The plant broke down during Sir Thomas's remarks and either this break or interference en route prevented his words from making the trip to London.

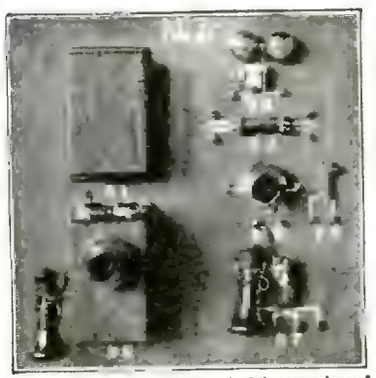
Mr. Hanson, in announcing the partial success of the experiment, said that the message reporting the result had been filed in London shortly after 6 o'clock, or about a half hour before the sending from this side had been broken off. The message, said Mr. Hanson, came via the Radio Corporation of America and was signed by Gordon Selfridge, proprietor of the London shop. It read:

"Large crowds witnessed the reception of the radio telephone test. Experienced much interference from ships' 'sparking.' Heard your music and singing. Test successful. Congratulations."

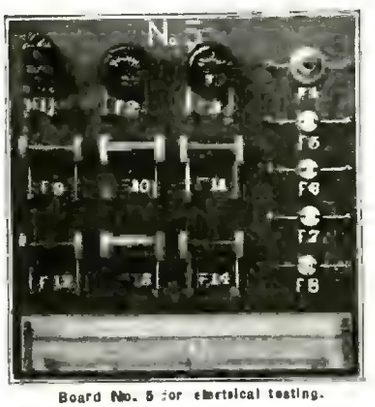
You Get FREE $500.00 WORTH of APPARATUS WITH THIS COURSE



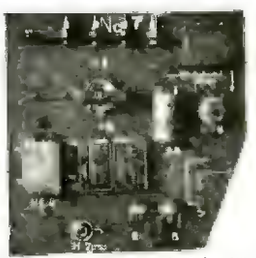
This is Board No. 1 of the Series of Electrical home-laboratory equipment the free use of which is given every student. (Size 24 by 24 inches.)



Board No. 3 of this wonderful new plan of studying electricity at home.



Board No. 5 for electrical testing.



Board No. 7 of this wonderful new plan of studying electricity at home.

YOU learn at home with tools and outfits we send you without a penny of expense to you. You become a high grade electrical expert in a short time through this wonderful easy course of study in your home laboratory—which we furnish free.

Simply worded lessons and wonderful laboratory outfits make study and experimental work a joy. Your absorb the knowledge and experience that will qualify you for a big salary in a shorter time than you can through any other Home Study course—and you get the best training obtainable anywhere when you join our great Home Student body.

Our Diploma will start you in a big paying position.

Learn Electricity at Home in Your Spare Time

EVERY year hundreds of young men from all over the world come to the residence school of the School of Engineering of Milwaukee to learn electricity in all its phases. Yet we know that there are thousands of ambitious men everywhere who aspire to big jobs in the great field of electricity, but who cannot conveniently leave their present work to attend a residence school. It is to train these men that this extension division has been formed.

Just Like Going to School

We knew from our long experience that the ordinary plan of teaching electricity by home-study methods would not measure up to the high standards set by the School of Engineering of Milwaukee, so we originated our home experimental laboratory outfit and instrument boards—equipped with actual, practical electrical apparatus—are furnished absolutely free to each student while studying. These laboratories are not toys—but include the same instruments and devices which the electrical man meets with in every-day work.

America's Greatest Electrical School is Now Brought to Your Home!

By our carefully perfected plan you can now secure almost every advantage of America's Greatest Institution of Electrical Education right in your own home! In this way this famous school now gives the most thorough practical intensive home-study course in electricity ever offered! It is a specialized, graded course built up on the most advanced ideas of electrical instruction. Thorough, yet simple texts—graphically illustrated give the electrical principles which logically parallel the practical experience gained in using the instrument boards. This amazing new method of extension instruction quickly makes any ambitious man a high-salaried, electrical expert!

Ten of these wonderful cleverly constructed

You Can Fill One of These Big Pay Jobs

The field of opportunity for the well-trained electrical man is practically unlimited. Billions of dollars are invested in this great industry. Thousands of men are employed in it—but the demand today is for men who are *trained specialists.* These men command handsome salaries—$2,500 to $6,000 and up to $10,000 a year and more. Why don't you get into this fascinating, highly paid field of work?

The Milwaukee School of Engineering is the largest and best equipped electrical school in the U. S. We have 1100 students who are now taking residence courses.

EXTENSION DIVISION

SCHOOL of ENGINEERING of Milwaukee

Dept. FF12, 137-147 Broadway, Milwaukee, Wisconsin

Extension Division,
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Please send me free and without any obligation on my part full details of your special new home-study course in Practical Electricity.

Name.....

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City.....State.....

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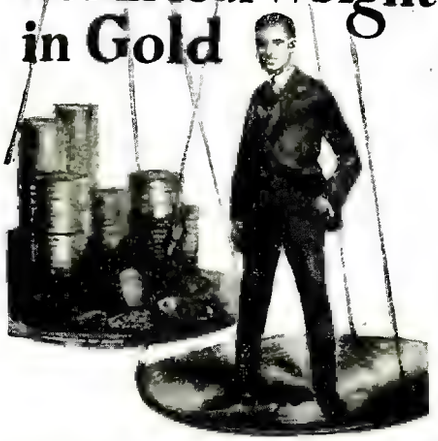
Make Yourself Worth Your Weight in Gold



According to the chemists, a man contains enough water to wash a pair of blankets, enough lime to whitewash a chicken-coop, enough phosphorus to make a thousand matches, and enough sulphur to kill the fleas on one dog. All this material can be bought at a drug-store at the junk price of 98 cents.

On the other hand, a man weighing 150 pounds, if all gold, would be worth $20.76 per Troy ounce or about $50,000, which, at 6 per cent interest, has an earning power of $3,000 a year, almost $60 a week.

Are you junk or gold? Many thousands of other men are proving themselves worth their weight in gold, or much more. They rise to this value by developing their Bigger Selves, by storing their minds with useful education.

Let us tell you, free of charge, how we are helping ambitious young men to become "worth their weight in gold" during their evening spare hours, through a new kind of correspondence instruction that brings "the most service for the least money." You can't afford not to avail yourself of this friendly counsel. Mark and mail the coupon below.

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"The Principal," 133 North 4th Street, Reading, Penna.

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Work like magic in emergencies or prove whether your door or padlocks are burglar-proof. **Open and test thousands of different locks.** Recommended by users in ten different nations. Most wonderful and only keys of their kind. Send $1 today. Novel key chain FREE with set.

MASTER KEY CO., 8L Manhattan Block, MILWAUKEE, WIS.

New Range Finders Compute for Gunners

Two instruments which, it is declared, will revolutionize the art of coast defense, are being exhibited in the Ordnance Department, and will later be installed at Panama to control the fire of the big guns in the canal defenses. The instruments comprise a system of ranging and following a moving enemy ship. They are electrically operated and automatically add, subtract, multiply, divide, and make allowance for many factors controlling the flight of a big shell.

Visitors to the larger coast defense stations often wonder how it is possible for the gunners to hit a ship with a great projectile shot from a gun seventy or eighty feet in length, when the enemy is thirty miles away. In the days of the Civil War, when small cannon shot iron balls weighing fifteen or twenty pounds, the range was usually pointblank, the enemy ship loomed large as a target and the gun pointer sighted by gazing along the barrel.

The greater distances, weights and charges used in modern mechanical warfare call for more accurate fire. In future artillery duels, army officers say, salvos will be exchanged at the rate of two or three a minute, and between volleys changes must be made in firing directions, and as there is so little time for this by hand calculation, some accuracy of fire is lost to speed.

The new instruments will constantly make these corrections. They are called the target computer and the battery computer. They are directed by two high powered telescopes located at fixed observation stations in the vicinity of the harbor defense. On sighting an enemy ship the observations are transmitted electrically to the two calculating instruments, where the exact location of the enemy ship is computed.

These new instruments, the fruit of severeal years' constant work and experiment, predict the advance location of the moving enemy, make allowances for the temperature of powder, type of shell, atmospheric pressure, direction and velocity of the wind and the drift of the shell caused by the big gun's rifling. Under the present system all these factors are added, subtracted and otherwise checked up and accounted for by human range finders.

A great advantage of the new system, which is called the Ford artillery computer system, is that provision is made for using airplane observations in the control, so that firing can be continued even though the enemy is obscured from the land observation posts by smoke screens or other causes.

Negative Gravity Again

From the result of certain pendulum experiments Majorana was led to conclude that a mass of lead exerted less gravitational force when surrounded by a jacket of mercury than when not so surrounded. To account for this he proposed a law of gravitation which is the same as Newton's law when no matter exists along the line joining the two attracting particles, but which, in the case that matter does there exist, has an added factor of exponential form that causes a reduction of the calculated force between the two particles. A Princeton astronomer has studied the consequences of this law when applied to the solar system. If the presence of matter between two bodies does diminish their gravitational attraction, then the attraction of the central parts of a sphere is reduced by the presence of the surface portions and the mass of the sphere as calculated from its attraction on other bodies will be actually less than its real mass. In the case of the sun its apparent mass would be only .33 of its real mass, the correctness of Majorana's constant of gravitational absorption being assumed. For the earth the corresponding fraction is .981, for the moon .997. We cannot disembowel the moon or a planet to find which law, Newton's or Majorana's, gives the correct value of the mass, but an application of Kepler's Third Law, shows that the proposed law carries implicitly with it other distances of the planets than those accepted on the basis of Newton's law. The mean distance of Jupiter from the sun would be 1.04 per cent less than the generally accepted value, and the planet's longitude would not agree with its predicted value. In the instance of the moon the new law would require the application of a different accelerating force. Its introduction would play utter havoc with the whole lunar theory. We are forced therefore to the conclusion that upon the hypothesis that there exists an absorption of gravitational force in matter, without change in its inertial mass, the coefficient of absorption cannot exceed one ten-thousandth of that derived by Majorana from his experiments, and must be hopelessly beyond the reach of investigation in the laboratory.

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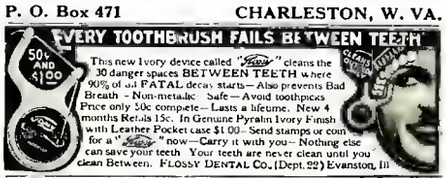

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Book Review

ELECTRICAL ENGINEERING TESTING. By G. D. Aspinall Parr, M.Sc. Hard covers, size 5¼"x8½". Published by E. P. Dutton & Co., New York City.

This excellent book is too full to be adquately reviewed in the space at our disposal. The greater part of the work is devoted to the subject pure and simple of engineering tests, illustrated by diagrams for the most part, and a very full presentation of formulas is given, avoiding however, or rather not using, the higher mathematics. The formulas used and all demonstrations come within the limits of anyone with a rudimentary knowledge of algebra, and yet cover a very wide range of work. As we approach the end, a somewhat more practical portion begins, illustrating such things as the different ways of joining wires and cables, descriptions of various apparatus, such as the potentiometer, various bridges, steam pressure indicators, and the application of the planimeter to their graphs, and quite a quantity of standard apparatus for electrical measurements is described and illustrated. An index of over twenty pages closes this work. We recommend it to our readers.

BLUEPRINTING AND MODERN PLAN COPYING. By B. J. Hall, M.E. Hard covers, size 5¼"x8½". Published by Sir Isaac Pitman & Sons, Ltd., New York City.

The firm of Sir Isaac Pitman & Sons are publishing a number of technical books, distinguished as a rule by being of limited and reasonable price. This little work within its one hundred and thirty pages treats of various ways of reproducing drawings, whether by plain printing or by photography. The latter method covers the much used photostat process, whose advantage is not only that it gives a more agreeable picture than the blueprint, but that it can reproduce a subject which is on opaque paper and printed on both sides. Both blueprinting and photostat work minutiae and appliances for carrying them out on the large scale, where much work is to be done, with a number of adequate illustrations, are comprised in the pages. Anybody can make a blueprint, but when it comes to turning out large ones in quantity and rapidly, adequate appliances must be used, and such are described here.

THE NATURE OF ANIMAL LIGHT. By E. Newton Harvey, Ph.D. Hard covers, size 5¼"x8¼". Published by J. B. Lippincott Co., Philadelphia, Pa.

Professor Harvey in one hundred and sixty-one pages of text gives a remarkably full treatise on this recondite subject. For years past we have heard about cold light, and it is definitely certain that the efficiency of our light producing appliances, when compared to animal light, such as that evolved by the firefly, is deplorably low. If a tungsten filament could be made to radiate cold light, such as the firefly produces, its efficiency would be fairly startling to us compared with the present ratio. In the book under review, there is an interesting mixture of physics and biology, and Professor Harvey shows himself thoroughly at home in both. The classic subject of course, as an example of high light producing efficiency, is the firefly, and very remarkable results or even absence of results, owing to the almost small quantity of heat which it radiates, show what a wonderful light producing machine the luminous insect is. The book cannot be too strongly recommended to our readers. A bibliography of nearly fifteen pages of fine print in the words of the author includes, "A few of the enormous numbers of papers on luminescence."

INVENTION THE MASTER KEY TO PROGRESS. By Rear-Admiral Bradley A. Fiske, LL.D. Hard covers, size 5¼"x8¼". Published by E. P. Dutton & Co., New York City.

It is not often that we have to review a book of so literary a cast as this one. Admiral Fiske goes far back in history, treating of invention in primeval time, in the Orient, in Greece and in Rome, before beginning what we would term the modern era of invention. This is the early part of the twelfth century, and although this is the earliest period in which we read about gunpowder and the manufacture of paper in Europe, the Admiral believes that both were invented long before this period. Paper was undoubtedly in use in China in the very early ages. It is interesting to find a considerable quantity of ethics in the text, showing that Admiral Fiske is a thinker whose horizon is very extensive. As it is usually to be expected however, the Admiral is not quite correct in his version of Galileo and the theory of Copernicus, for Galileo failed in proving the theory, but merely upheld it by analogy. We refer him to the Encyclopedia Brittanica article on Galileo as a good presentation of the subject.

(*Continued on page 813*)

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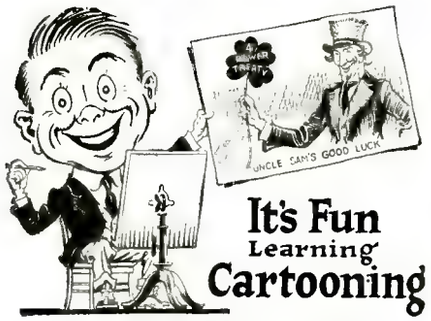

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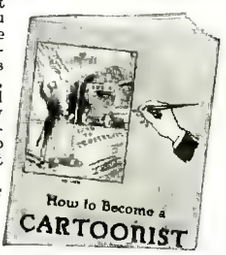

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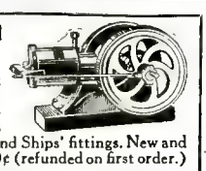

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Bathe Mfg. Co., Dept. 2-5214 Woodland Ave., Phila., Pa.

Motor Hints

LIMOUSINE LIGHT

(*Continued from page 760*)

read. Present-day cars are, as a rule equipped with the usual dome lights, but these lights often can not be used, for the reason that interior car lighting in many cities is prohibited. Also, when a chauffeur is driving in the night time, the interior dome light throws bad reflections upon the glass wind shield in front of him, and it is therefore not safe to have the interior of the car all lit up. On the other hand, even the best dome lights do not throw a good light on newspapers or magazines. What is wanted is something that does not disturb the chauffeur or violate the traffic rules, and at the same time will give the occupant light for reading for the half or three-quarters of an hour which he spends riding home.

The idea shown on our cover and also in the sketch herewith was originated by Mr. H. Gernsback, who tried out the scheme successfully.

The device is very simple. It consists of an ordinary wooden board about 12 inches long and 8 to 9 inches wide. At the head of this board is provided a sort of shallow box, which has one or two electric light bulbs, which by means of reflectors, emit light rays almost parallel to the surface of the board. When a newspaper or magazine is placed upon this board, it will be lit up, but no light, or very little, will be diffused in the interior of the car. The light, it will be noted, is where it should be, namely, on the print; it does not shine into the eyes of the user. An ordinary flexible cord is attached at the head of the board, and this cord at the end has an ordinary telephone plug that can be secured at any electrical or radio store. A telephone jack is then let in anywhere in the framework, either in the side of the car, or behind the chauffeur's seat. When connection is desired, all that it is necessary to do is to plug in the light, and when one has finished reading it can be unplugged and the board can be placed under the cushions or in some other convenient nook in the interior of the machine. The device, once tried, will always be used.

It is known that when riding and reading the eyes tire very quickly when the arm rests on the usual arm rest provided in automobiles. It has been found that when the arms are pressed tightly against the body and the newspaper is held between the hands, the newspaper or magazine will shake at the same rate as the body, in practical synchronism with it, and there will be no strain upon the eyes, no matter how hard the car shakes when passing over any unevenness in the road.

GARDEN HOSE TO AVOID FIRE HAZARD FROM BATTERY

To avoid repetition of a fire, which a local motorist experienced recently from a short-circuit on one of the wire leads adjacent to the storage battery, this motorist has adopted the means shown in the present sketch to safeguard the car. In the instance referred to, the battery wire came in contact with part of the frame of the car. The insulation was cut through and the wire shorted, heated and started the insulation burning, with the result that the flame soon reached the upholstering of the seats.

Through the efforts of another motorist with a chemical extinguisher, the flame was kept from the gasoline tank. After this exciting experience, the battery was rewired, and a four-foot length of hose added to keep the wire out of contact with the car frame, rods, pipes, etc. This improvised insulator

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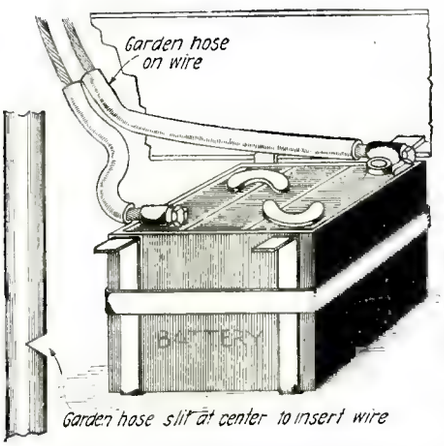
was cut partly across at the center and the leads, carried through each section to lead them to the proper terminal of the battery.

Contributed by G. A. LUERS.



It Frequently Happens That the Heavy Lead Wires from the Car Storage Battery Have Their Insulation Scraped Off in Places, or Else Rotted Away, With the Consequent Danger That a Diastrous Short-Circuit May Occur. These Heavy Wires Are Best Enclosed in Short Lengths of Garden Hose, Which Provides a First-Class Insulation Easily Installed.

OPERATING MAGNETO HORN WITH BATTERY

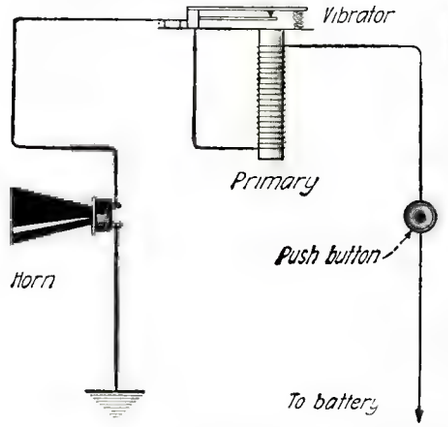
At various times it is desirable to use the horn when the engine is not running. This is not possible with the average Ford but if it has a battery the horn can be made to run on battery.

Secure an ordinary buzzer or make one out of an old spark coil as I did, by connecting the vibrator in series with the primary winding, as shown in the sketch. Mount the buzzer on the board above the horn or any suitable place and connect as shown in the diagram.

If a spark coil is used, better results can be obtained if the high-voltage contact is connected to the other binding post or to the frame.

Good results can be obtained with this horn and it will be found serviceable when the engine is not running.

Contributed by W. W. FOSTER.



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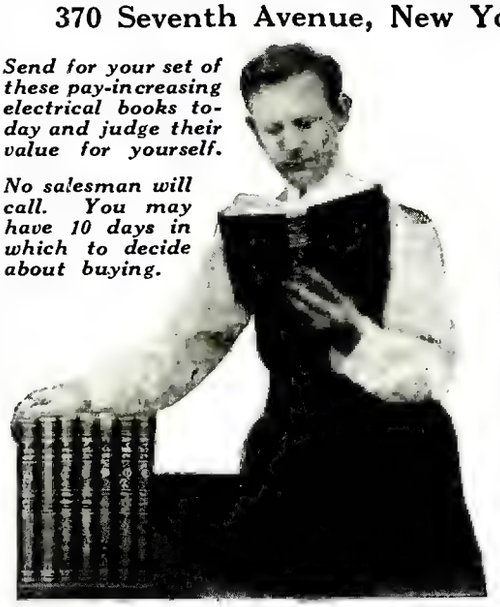

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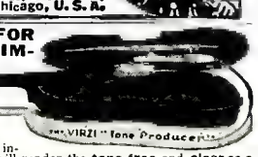

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Build Your Own Reflecting Telescope

By C. E. BARNS

(*Continued from page* 758)

ratio when the diameter is only doubled; that is, a ten-inch gives not twice but four times the power of a five-inch, and other sizes in due proportion. I have a nine-inch, of sixty-eight inches focal length, and the difference between them is to the very marked advantage of the larger.

The construction of the mounting we will take up in a later section of this paper; but as a preliminary injunction I would recommend beginning the construction of the mounting simultaneously with the work on the mirror. The reason is a very human one—for the process of grinding and polishing is so engrossing, with enthusiasm growing apace with each stage of development, that the desire to put the finished product to test on the heavens is a very natural one; and if one must wait for the mounting after having struggled so long, although interestedly, with the speculum, and then be compelled to put off the finishing processes till after the mounting is built, one's enthusiasm suffers something of a check. It is one of the greatest delights in telescope building to be able to slip the finished product right into the tube under the stars and give it its first real try-out, and for that reason I always counsel novices to do the work simultaneously. Besides, the construction of the mounting will be found to be a pleasant relief from the rather monotonous labor over the grinding-tool.

With the differences between refractors and reflectors in general and the laws and rules which govern their optical principles, we need not deal in this paper, since any good encyclopedia will inform the novice fully and accurately, on this point and as to the different forms of the reflector. We will concern ourselves with only the practical side of constructing a Newtonian, so-called, since Sir Isaac Newton constructed the first one with his own hand—a tiny thing of only two inches aperture—exhibiting it for the first time before the Royal Society of England. Yet from this tiny model able men have developed the reflector till now (culminating in the great hundred-inch mirror at Mt. Wilson), the instrument of the future is undoubtedly the reflector; for whereas, owing to the enormous cost and difficulties of construction, the limit of refractors has about been reached, no one can predict what great reflectors will yet be mounted and put to the highest uses, chiefly in the domain of celestial photography. A preliminary reading-up on this subject, using such authorities as almost any public library affords is recommended.

Having decided upon the size of your instrument, the first step is to procure your glass for the speculum. As only the surface-reflection is used, so-called optical glass of lens fineness is not necessary. This is fortunate, else the initial outlay might run into some hundreds of dollars instead of only five or six dollars for a selected piece of plate glass cut, let us say, ten inches in diameter, ground at the edges, free from scratches and surface flaws, and as thick as possibly can be obtained of any commercial plate glass dealer. This may be two inches, but more likely one and three-quarters, or at least one and one-half inches thick; but anything thinner for a ten-inch

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is not recommended. Secure at the same time another disc of glass of the same size and grade, though it need not be more than three-fourths of an inch thick. This will serve as a "tool" upon which the grinding is done.

As you value peace in the family, do not attempt speculum-grinding within the four walls of your neatly-groomed home; for with the drippings of carborundum, emery and jeweler's rouge, the immediate region of the grinding-post will be pretty well messed up before your pleasant labor is done, and your clothes and person generally (in spite of an enveloping apron), will resemble a potter's at the close of a busy day. Choose rather a shed or some sort of an outhouse before an open door affording light and air as well as a pleasant prospect, perhaps, for the work grows tedious at best after the first few hours. A twenty-gallon iron Standard Oil drum, filled with water to give it weight, resting on a stout box filled with crushed stone, itself standing on the solid earth through a hole cut in my observatory floor has afforded me a solid foundation for the tool which is securely cemented on the drum-top, perfectly level, and of a convenient height for steady work. The more light and airy the surroundings the more pleasurable the work becomes.

A template for testing the curvature of the mirror is easily made and is quite indispensable. Having decided on a ten-inch speculum, let us say, you will next determine the degree of curvature—in other words, the focal length. The degree of curvature may be anywhere from six-to-one to twelve-to-one, a reasonable average being about nine-to-one. This gives you a focal length of ninety inches, for a ten-inch mirror. Lay down a straight piece of batten twice the focal length, or one hundred and eighty inches, on some bare floor. Drive a nail in one end, securing it sufficiently to serve as a fulcrum, measuring the exact length on the rod and driving a sharp tool through the wood so that when it is moved from right to left the tool will scratch a curved line beneath. A flat piece of zinc may thus be marked so that with a pair of tinner's shears a satisfactory template can be made. As this metal gauge represents the approximate curvature of your mirror, as the grinding proceeds your progress can be noted by standing the convex edge of the template across the mirror at its center. When the grinding has reached a point where the template fits the concavity of the glass, the fine grinding and polishing may begin.

Another way of testing your progress is to cover the speculum with warm water (never cold, or you will crack your mirror), and hold the glass in the sunlight where it will throw an image on the wall at about the focal distance—ninety inches. At first this image will be almost as large as the mirror; but as the grinding proceeds, the image on the bare wall or white sheet of paper, will be seen to grow small, till at last it will appear as a burning bright spot about the size of a half-dollar, at which point grinding may cease.

As an abrasive I used various grades of emery on several mirrors, but for rough grinding carborundum is far superior, working much faster. Secure half a pound each of five or six grades from "40" to "200," and a pound of the finest emery-flour for the finish. Two hours' grinding with each of these grades, finishing with the emery, will bring the desired curvature to the glass; perhaps even less time than that; but if you get your full concavity within nine or ten hours (working from twenty minutes to an hour a day), you will do well. A teaspoonful of the abrasive mixed to a thin paste with a little distilled water is sufficient for each grinding; and before

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resuming operations the day following, wash off the glass thoroughly. Especially as you proceed from one grade to another, *wash off every grain of the preceding grade*, else you will have pits and scratches which will be very troublesome to grind out.

Most amateurs find the grinding comparatively easy, but the polishing long and difficult. This is mainly because they have not carried fine grinding far enough.

A wonderful surface may be obtained by using the emery in various grades of suspension. Place the pound of emery in a fruit-jar and nearly fill with distilled water. Shake well and let it settle one minute Pour off the water into a second jar and spoon out the emery down within a half-inch of the bottom where the heaviest grains have settled. Shake this emery in the second jar of water and let stand for ten minutes. Pour water into jar 3, and spoon out the top half of the emery, proceeding as before, allowing the abrasive to settle for one hour. The final "washing" should be ten hours or more, this last grade being of course the very finest emery dust. By using the top layers of each grade, and washing between, giving each ten to fifteen minutes' grinding, the surface of the mirror will leave a texture that will make polishing comparatively easy.

In grinding I use three circular strokes to one straight across; in polishing, the straight stroke is preferable. In making each turn in the circular stroke it will be noted that one-third of the mirror is off the edge of the tool all the time and the central portions always grinding—which accounts for the puzzling phenomenon of increasing concavity. I never use extra pressure than the weight of the glass. With every stroke I turn the speculum by the handle an inch or two, at the same time taking one step to the left around the post, making a complete circuit about every ten or twelve strokes. Thus the grinding proceeds evenly.

The method of polishing is exactly the same as the grinding except that the tool is now covered with a layer of black pitch; and instead of an abrasive, red oxide of iron, or jeweler's rouge, is employed as a polishing agent. I have had the best success with Snow's grafting wax (to be had of almost any dealer in horticultural supplies), being of just the right texture and free of any foreign matter, and neither too soft nor too hard. However, ordinary commercial pitch will do, melted and strained, with a little turpentine added to soften it, so that when cold it can be easily dented with the thumbnail. While warm, but not too hot, flow the pitch over the tool to the depth of a quarter inch; then having first wet the speculum with castile soap and water, press the mirror down on the wax, moving it around and around till a perfect impression is obtained. Before it is quite cold, lay a straight-edge across the tool and with a knife dipped in soapy water cut V-shaped grooves clean across the face of the tool about an inch apart, then another series crosswise so that your tool is now a series of inch-wide squares. Clean the tool with soap and water and let harden.

Place a pound of the rouge in a jar of distilled water, shake and let stand overnight. Pour off the water (leaving about an inch to cover), and spoon off only the top portions for polishing. Cover each square with this washed rouge, and proceed to polish with a straight stroke, twirling meanwhile and keeping in constant motion around the post. Within twenty minutes or so the center will be seen to brighten, and little by little the whole concave surface of the speculum will polish. As a finishing to this process—for you cannot have too brilliant a surface—I have used with success a coating of pure beeswax over each wax-square, the melted wax laid on very evenly with

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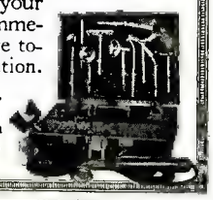

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a single stroke of a fine surgical gauze brush. The best wax for this purpose is that used by bee-raisers for foundation-comb. It comes in sheets and is highly refined and dustless, and is cheap. Of one this make certain: do your polishing with windows and doors closed, as one grain of sand or even dust blown on to your glass during the process will possibly ruin it and drive you back to grinding again.

You have now perhaps a speculum in perfect curvature, but this is not enough. It must still be parabolized—that is, made a little deeper in the center, so that the rays from all parts of the mirror will focus to a single point instead of distributing along the focal plane. In other words, the wax or pitch on your polishing tool must be pared down at the edges so that the center receives almost all of the wearing away of the glass, and the mirror thus receives an imperceptible dip. If you leave the central squares intact and widen the grooves toward the edges of the tool till the outer squares are about half their original size, then proceed with your polishing as before for about fifteen minutes, you will reach the approximate depth of parabolizing, the test of which is in your telescope on the moon or a star, or best of all the Foucault knife-test which is now to be explained so that anyone can accomplish it.

This requires no elaborate apparatus. Set up the mirror vertically against the wall of a darkened room. Opposite this place a small table about on a level with it, and at a distance twice the focal length, as when making the template. On this table place a deep tin coffee-can in whose side, directly opposite the mirror, is punched a very fine hole with a needle. Suspend opposite this hole an electric bulb, flashlight or oil-lamp. This will serve as an artificial star. Now to the left of this point of light, and on a level with it, set up a safety-razor blade flatwise toward the mirror. Bring the eye close to the edge of the blade and move the lamp sidewide till the artificial star is seen to illuminate the whole mirror. By moving the knife-edge slowly, the mirror will be seen to darken uniformly over its entire surface, if the parabolizing has been carried far enough. If there are inequalities, the speculum must be returned to the polishing-tool whose pitch surface must be cut to smooth down these particular inequalities, and another test made. By careful practice and successive tests a perfect parabolic form may be reached, but care should be exercised not to over-parabolize as it means a return to grinding again. Likewise at this center of curvature if the image of the artificial star is viewed with a low-power ocular, it will be seen to be a ragged disc of light about the size of a dime; and if by crossing and recrossing the field with this disc of light it remains sharp and clear to the very edges, the mirror is testing well and can be placed in the telescope for tests on the moon and stars.

(*To be concluded*)

BRONZE BONES IN LIVING MEN

Living men with bones of bronze may soon be a common sight, according to an important announcement to the Academy of Science by Professor Doumer, disclosing a method by which large quantities of copper may be introduced into the human organism by means of electricity.

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(*Ed. Note—Fine! Only the Prof. forgets that copper sulphate in the blood stream is extremely poisonous and deadly.*)

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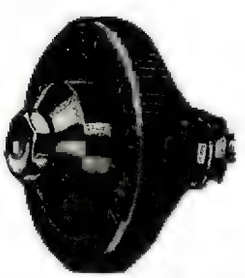

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Radio News, October Issue Page 649

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..Asthma	..Female Disorders	..Neurasthenia
..Hay Fever	..Insomnia	..Falling Hair
..Obesity	..Short Wind	..Weak Eyes
..Headache	..Flat Feet	..Gastritis
..THINNESS	..Stomach Disorders	..Heart Weakness
..Diabetes	..Constipation	..Poor Circulation
..Rupture	..Biliousness	..Skin Disorders
..Lumbago	..Torpid Liver	..Despondency
..Neuritis	..Indigestion	..Round Shoulders
..Neuralgia	..Nervousness	..Lung Troubles
..Flat Chest	..Poor Memory	..Stoop Shoulders
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The Chemistry of Stains

(*Continued from page 767*)

stain covered with baking soda. Boiling water should then be poured through the cloth until the soda is dissolved and the cloth let sag in the liquid for a while.

If the stain is an old one then the treatment depends upon the goods. For wool, silk, colored and delicate materials, a 50 per cent. solution of ammonia in alcohol should be made and the stain treated with this. If the color is affected chloroform may be used to restore it. For other fabrics, the stain should be moistened with dilute oxalic acid and this then neutralized with ammonia.

Grass. If the stain is a fresh one then the fabric should be stretched over a small bowl or dish and the spot wet with denatured alcohol until the stain is removed. If the stain is several hours old then the stain should be wet with water and equal parts of common salt and cream of tartar placed upon it. If the color of the material is affected by this then the spot should be moistened with ammonia and treated with chloroform.

Grease and Machine Oil. This stain can generally be removed by treating it with a mixture of gasoline and carbon tetrachloride, but if this does not help then the spot should be covered with fuller's earth or chalk. A blotter should be placed over this and pressed with an iron that is not too hot, so that it will not injure the fabric. Rub the spot full of butter or lard and wash with soap and water.

Ink. If possible ink spots should be treated immediately after the material has been stained. To do this the spot should be wet thoroughly with warm milk and a clean blotter weighted upon it. As the ink is absorbed the blotter should be changed. Sometimes a little bit of chalk can be used to a better advantage than the blotter. If the stain is an old one then the treatment is the same as for dyes. On a carpet, if the ink has not had time to dry, scrape with a spoon into a bowl, add water and continue spooning; do not let the spot dry but keep on adding water and spooning until the ink is gone.

Iodine. This can very well be removed by treating the spot with wood alcohol which dissolves the iodine. A 10 per cent solution of potassium iodide can also be used.

Paint. Paint stains are best removed by treating the spot with benzine, turpentine, or carbon tetrachloride. If the material be of silk then no turpentine must be used. If taken in hand at once they can often be washed out with soap and water.

Rust. This stain should first be wet and then covered with a mixture of equal parts of salt and cream of tartar. Now hold this in the steam of a tea kettle and remove the mass. If the color of the goods be affected then treat the spot with ammonia and follow with chloroform.

Scorch. A paste of boiled starch should be made and laid over the spot. When this has thoroughly dried it should be brushed away.

Tar. This is best removed by means of soap and some good oil which will dissolve the tar.

Varnish. The treatment for this is the same as for paint.

Wax. All the wax that can be removed from the surface should be taken off and a piece of brown paper put under the spot. A paste of starch is then made and it placed over the spot. A piece of brown paper is put over this and pressed with a warm iron. If the stain does not come out the first time the process should be repeated.

Contributed by

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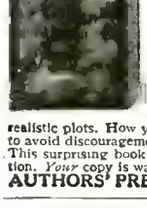

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PECULIAR PERPETUAL POWER

(664) E. Duyer, Brooklyn, N. Y., submits a diagram of a steam engine in which the heat is to be developed by compressing air, water is then to be forced into the cylinder when hot, consequently causing steam to drive the engine.

A. We doubt very much if the compression stroke of a marine engine similar in design to a Diesel engine, will compress the air to 500 pounds per square inch. We are positive, however, that it will under no circumstances raise the temperature of this air so compressed to 100° C. Consequently, the effect of squirting water into the cylinder would not cause this water to become steam. We believe that a great amount of energy would be required to force water into the boiler, and a lot of efficiency would be lost in trying to compress the air. Furthermore the piston would have to be heated much above 100° C., viz., the boiling point of water. We would suggest that you forget the idea entirely.

WRITING INSTRUMENT

(665) Abner Dozier, Forney, Texas, enters a diagram of a writing instrument employing four solenoids to guide the stylus.

A. We would not suggest application for a patent on your writing instrument for the reason that it is very similar indeed to the now perfected telautograph. The latter uses three solenoids instead of four, every movement being possible with the same. With the same three solenoids it raises and lowers the pencil from the paper. The stylus is worked by current flowing through wires as in your device, except that instead of using five leads and one common return, this uses three leads with a ground return.

RAIN ALARM

(666) De Forest Dykes, Mayville, Mich., enters a sketch of a rain alarm and requests our opinion of the same.

A. There is nothing new in the alarm designed by you, and we most assuredly advise against attempting to patent such a device.

SOME NEW IDEAS

(667) Austin Duff, Woodhaven, L. I., submits several questions, the natures of which are made clear in our reply.

A. You have submitted three questions on some very original ideas. In the first place, an automobile engine that needed no gas, chemicals or other fuel supplies, and would not convert oil into gas, is in our opinion impossible. In order to have this engine operate, it must consume some sort of fuel regardless of what that may be. From your description we believe that you are speaking about a perpetual motion machine, which, we believe, cannot be made.

There are many phonographs that will play more than one disk record when the machines are once set up, without the necessity of changing the records by hand. These phonographs are not, however, intended for home use, being entirely too expensive and rather elaborately constructed.

There is no instrument that will change the voice in such a manner that it will be recorded in words, on a moving tape. This so far has been impossible. The voice itself can be recorded on a moving tape, or on a paper, but it is the vibrations which actually form the record, not the written word. Several attempts at such a machine have resulted in devices which although they operated, were far from satisfactory. A machine of this nature would indeed be a blessing. The peculiar pronunciations in the English language prevent this construction—for instance, such a phonetic typewriter would write the word "Physics" as "Fiziks."

CRYSTAL DETECTOR

(668) E. Douchamps, Marcus Hook, Pa., asks whether a specially constructed multiple cat-whiskered detector could be patented.

A. We believe that your detector is patentable. In order to apply for a patent, the best procedure would be to enlist the services of a reliable attorney. We do not believe that a detector of this nature has appeared upon the market. Nevertheless we caution you against applying for a patent on such a detector, unless you yourself can have the device manufactured or can manufacture it and force its sale by means of extensive advertising. At the present time, such a device would sell, but the vacuum tubes far surpass the crystal detectors for general utility.

WASHBOARD

(669) Dante Cacici, Brooklyn, N. Y., enters a sketch of a washboard with movable rollers instead of a corrugated sheet. He requests our opinion.

A. No doubt the washboard which you have designed could be patented. However its efficiency is practically zero. What good is a washboard in which the surface itself will roll under the pressure exerted upon it? It is quite evident that the reason the modern washboard is corrugated in form is because of the fact that it presents very good friction or rubbing surface. Any attempt to do away with this friction, as for instance, substituting rollers for the corrugated surface, makes the washboard absolutely worthless as far as its use in the home is concerned.

SOUND PRODUCER

(670) Frank Cornilglis, Tallulah, La., asks: Could I patent a device to make a Ford car sound like a racer?

A. Making a Ford sound like a racer will not in any way increase either its speed or its power; it is like permitting a Mexican hairless dog to bark through a Magnavox; in other words, the idea sounds big but means nothing. An evening dress suit does not make a millionaire, neither will attaching a device to the exhaust make a Rolls-Royce out of a Ford, and except for a few casual bluffers who will pay $3.00 for a joke, the device would not meet with any sale worth speaking of.

OXY-HYDROGEN AUTO

(671) Max Cohen, New York City, asks: Could I patent an automobile in which I decompose water into oxygen, and hydrogen, which gases explode in an engine driving not only the generator producing electricity but also the auto?

A. The apparatus which you have designed will

U.S. PATENTS

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never under any circumstances operate, for the reason that the amount of energy required to decompose water is greatly in excess of the explosive power developed by the mixture of the gases. Consequently, immense storage batteries would have to be employed to constantly decompose the water, which power could be more efficaciously applied directly to an electrical driving motor, than to the electrolytic decomposition of water. This device, which you contemplate constructing, is old; four and a half years ago we published an article upon the same. The inventor of the scheme has already disappeared, but his partner still laboring under the impression that this perpetual motion machine will operate, is endeavoring to complete the work. In our opinion his life will be spent in useless toil.

SCRATCH ELIMINATORS FOR PHONOGRAPHS

(672) Hyman Biegeleisen, New York City, submits a sketch of a diaphragm tightener to eliminate the scratch from records.

A. We doubt very much the claims made by you in your recent communication. Although you will cut down some of the rattle in the diaphragm of your phonograph reproducer, you simultaneously decrease the volume of sound emitted from the same. Consequently, if you have not gained in one way, you lose in another way.

TIDE POWER MACHINES

(673) L. W. Strong, San Francisco, Calif., asks: What are the difficulties met with in building tide power machines?

A. Tide current power can be successfully used to develop electrical energy. The drawbacks and difficulties which hinder practical operation are particularly those due to the fact that the tide shifts, and during this change there is practically no power developed. Secondly, the difficulty and extreme cost of building a plant large enough to produce results and the very low head of water pressure, and third, the many difficulties which beset such an installation, as for instance, storms, frost and floating debris. To our knowledge, there are patents upon many tide current motors, but none of these are being used upon a commercial basis, judging from the reports we have received. Wave power machines are, however, being employed successfully in several instances, on a small scale.

AN EXCEPTION TO OUR VIEWS

(674) Guilio Ricci, Eureka, Calif., writes: Referring to Joseph Akelaitis's claims on perpetual motion, I would like to know why you say that you doubt his claims? Didn't he give you full information regarding it or is it so complicated that you have not solved it fully? Please give me an early response as I am very much interested.

A. During the course of giving patent advice in this publication, the writer has answered about eight thousand letters claiming perpetual motion In each and every one of these perpetual motion systems, when the same were placed upon paper, regardless of the rabid claims made by the inventor, we have disproven the possibility of perpetual motion, not only by figures but by ordinary reasoning. Mr. Akelaitis submitted a photo of his device, which he claimed actually worked. Further than that we had no information regarding it. Do you wonder then, in view of the fact that eight thousand or more perpetual motion devices have been actually disproven, that we should doubt the claims?

It is a very simple matter for anyone to make an assertion that his perpetual motion machine actually works. It is a very different matter to prove the same, and not until a man actually obtains a patent on a perpetual motion machine as such, and not until those specifications and claims state that this device will run until the parts thereof wear out, will we entertain the belief that an inventor has actually discovered perpetual motion. The Patent Office insists upon a model of a perpetual motion machine, and up to the present time, in spite of the fact that thousands of inventors have striven to accomplish this result, no patent on a perpetual motion machine has ever been granted nor has a working model been submitted.

If any reader cares to submit to us his data, we will be very glad indeed to give our decision, but full details of the apparatus must be given in order to enable us to give accurate and detailed information. Unfortunately many inventors who claim the discovery of perpetual motion believe that the world is going to steal their invention away from them, and therefore, refuse to disclose the details of the apparatus. We do not care to incur the animosity of our readers, and therefore, in giving advice, we inform the inventor that he has not given enough data to warrant detailed reply, permitting him to choose whether he cares to submit further information, or whether he desires to let the matter drop. We have not come across a perpetual motion machine or any other machine up to the present time, which is so complicated that it could not be explained. Every perpetual motion system is simple when it is reduced to its final state or ultimately analyzed, most of them having added complications which do not in any way assist the device in its purported operation.

MUSICAL INSTRUMENT

(675) Joe Bradera, Atascadero, Calif., submits a sketch of a zither-like harp and asks our advice.

A. Freak musical instruments are not by any means unusual and yours would come under that class. In view of the fact that the music derived from the same is practically identical with music from a good zither, and in view of the fact that the device is nearly as cumbersome as a harp, and because these classes of musical instruments are not used to any great extent today, we would not advise applying for a patent.

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Practical Chemical Experiments

By Prof. FLOYD L. DARROW

(Continued from page 762)

the residue in acids as just described, and subject any insoluble residue to the treatment for such substances which will be described below.

Insoluble Substances.—The most common of these are the sulphates of lead, barium, strontium, and calcium to some extent, silver chloride, silver bromide, and silver iodide, the oxides of tin, aluminum, chromium, iron and silicon, calcium fluoride, and most of the silicates.

The preliminary tests already given may have supplied important indications. If they have not, try the following tests.

1. Pulverize the substance finely and heat it with sodium carbonate on charcoal, moistening it with a drop of water. Lead, silver, and tin, if present, will give metallic globules. To distinguish them warm the globules with dilute nitric acid. The silver and lead will dissolve but the tin will give a white insoluble residue. To the solution apply the test for Group I and discover which of the other two metals is present.

If tin is found pulverize the substance and mix it in a porcelain crucible with six times its weight of a mixture consisting of equal parts of sodium carbonate and powdered sulphur. Fuse this mixture over the Bunsen burner. Upon digesting the fused mass with water the tin will go into solution and may be precipitated as a sulphide by the addition of dilute hydrochloric acid. Filter off the insoluble residue before adding the acid.

2. *Silicates.*—Prepare a bead of sodium carbonate in the same manner as a borax bead. Touch the hot bead to a little of the finely powdered substance. If effervescence occurs, a silicate is probably present.

If a silicate is indicated, place a mixture of it with four times its weight of sodium and potassium carbonates on a platinum foil and fuse in the Bunsen flame. In a porcelain dish add dilute hydrochloric acid to the fused mass until the carbonates have been decomposed. Then evaporate to dryness over a small flame. Cool the residue, add concentrated hydrochloric acid, and dissolve in hot water. Filter off the separated silica and then test the filtrate for the various groups of metals in the usual way.

3. *Insoluble Salts of Calcium, Barium and Strontium.*—By applying the flame tests these metals can usually be detected. Moisten the substance with concentrated hydrochloric acid and make the test in the usual way, using a clean platinum wire. The substance will not be in solution this time, however, but the moistened powder will cling to the wire, and vaporize in the flame just the same.

To determine the presence of sulphur as sulphates or otherwise, fuse the substance on charcoal with sodium carbonate in the reducing flame of the blowpipe. Place the fused mass on a silver coin and moisten with a drop of water. If sulphur is present a dark stain will be left. This means that the sulphates of the metals found by the flame test are undoubtedly present in the original substance.

To determine the presence of barium and strontium sulphates, fuse on a platinum foil with sodium and potassium carbonates. This will convert the sulphates into carbonates which will not dissolve in boiling water. Filter and dissolve the residue in oxalic acid. Then test for barium and strontium in the usual way.

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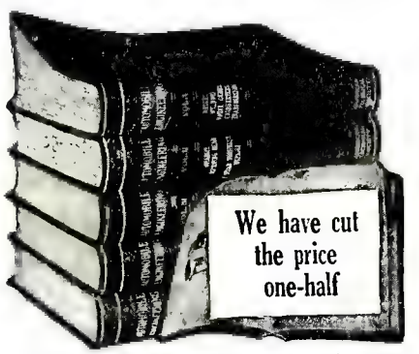

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Calcium sulphate is soluble enough in water so that it can be detected in the usual procedure for the metallic groups. The same is true of calcium fluoride if boiled with dilute hydrochloric acid.

4. *Chromium and Aluminum Oxides.*—Fuse these with sodium carbonate and potassium chlorate on a platinum foil and boil the fused mass with water. If the solution is yellow giving chrome yellow with lead acetate solution, chromium is present. The aluminum may be detected in the filtrate by the usual method for this element.

In following the above procedure the metals of the first two groups should be absent.

We have now given a very complete outline of qualitative analysis and any future articles will turn to another field.

Future Air Traffic

By H. GERNSBACK

(*Continued from page* 738)

in cities now. In most cities motor cars are not allowed to travel at a rate of more than 20 to 25 miles an hour. Some similar rule will probably be made for airplanes as well. Another rule will have to be added for airplanes, and that is the *height of the flying level.*

All this regulation would be effected by means of huge towers erected at important points in our cities. In New York City, for instance, one of these structures as shown in our illustration would be erected somewhere in the Times Square district, another at the Battery, a further one at 125th Street, etc. These huge towers would provide landing platforms, as shown in our illustration, where all airplanes, be they Express, Interurban, Suburban or Local, could stop, if necessary, to discharge passengers. There would be waiting rooms on all the platforms for the different levels, as shown in our illustration, while swift elevators would dispatch the passengers upwards or downwards as required. Of course there would be many different platforms, as all airplanes would have to follow certain directions over the city, all depending upon the Traffic Commission. In flying around these aerial structures, it would not do to have all the airplanes fly in every direction. They would have to adhere to certain well-defined lines; for instance, East, South, West, North, and other points of the compass, as required by the local requirements.

In our illustration we have shown these various platforms, such as the South, North, West, and East platforms, which would be used only for airplanes coming or going in these directions. These platforms would perhaps be built in doubles or triples on each side of the tower for the following reason. Suppose 15 airplanes wish to stop on the South Local platform, one after the other. Now it is obviously not possible for all of them to make a landing at the same time, so we shall provide a number of local platforms, one right above the other, if necessary. Those that could not effect a landing would simply have to go on and keep circling to the aerial structure until a platform was available. Inasmuch as there would be so many platforms it would take only a few minutes, even if there were many airplanes, to find an unused platform on the Local level, which platform might be the South, West, North or East; it makes no difference. The reason is that if the Local airplane kept on flying, that is, circling around the aerial structure, it could approach either the East, West, South or North platform, as the aviator would see best fit to land.

There would, of course, be many refinements in connection with such traffic which it is impossible to predict as yet, and which would have to be found out by actual practice, the same as our present traffic systems came about through actual experience.

Spatter Work--How It Is Made

By DR. ERNEST BADE

(*Continued from page 763*)

and it is made by drawing strings firmly across numerous pins arranged in the likeness of a cobweb.

Now the paper is ready to receive the ink. The brush held in the right hand, is lightly dipped into the ink and, with a gentle pressure it is carefully drawn across the screen held in the other hand. Tiny spots or dots will now make their appearance over the unmasked and uncovered parts of the paper. When the ink has been evenly distributed the topmost leaf is taken off, and the brushing begun again. In this manner one leaf after the other is removed while one design after the other appears on the paper.

A Pretty Design for a Picture Frame Border, Suitable for Use On Photo Mats, Was Formed With the Aid of Leaves, and Paper Clips; the Spatter Work Was Applied Over These.

When the design has reached the desired depth or darkness, the mask is removed. This will leave a perfectly white margin. The leaf which was taken off first will now be very dark while the leaf which was taken off last will be nearly white. Between these two extremes all possible shades will occur, and if a number of colors have been used before the background has become too dark, a pleasing effect will be obtained.

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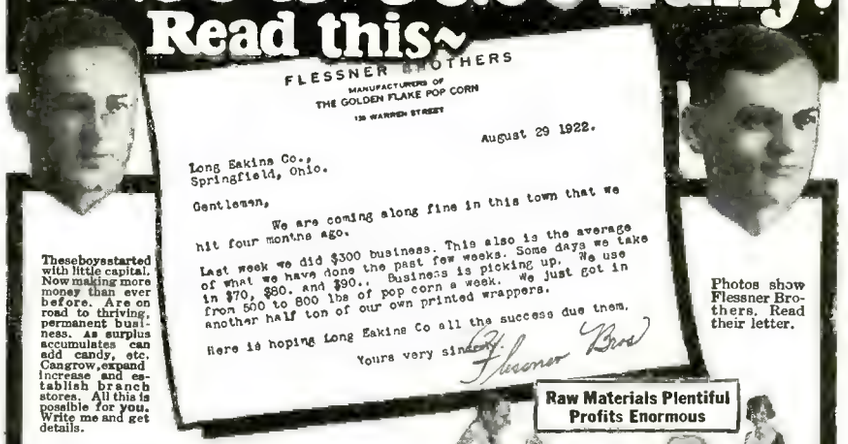
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The Amateur Magician

By JOSEPH H. KRAUS

(*Continued from page* 759)

the cartridge. In this longer opening is placed a circular steel block, having a wire securely embedded in one end. The wire passes downward to the bottom of the block where it is looped. The looped wire serves the purpose of resetting the trigger. At right angles to this trigger hole another hole is drilled which provides for the insertion of a pin to hold the striking hammer. Two electro-magnets are taken from a bell and fitted with short curved extensions, made of soft iron. The armature of the bell from which the contact spring has been removed, has had a small steel pin inserted into its center. This pin penetrates the aforementioned hole, where it holds the striking hammer under tension. When current is permitted to flow into the coils, the armature is pulled toward the magnet and this action releases the hammer which in turn is driven upward by the action of the spring where it strikes the trigger, the blow being transmitted to the cartridge which explodes its charge. The circuit is completed by wires passing down the legs to metal pins protruding from the heels of the shoes, making contact with segments in a wired carpet leading to a battery and switch, which in this case was the rifle which I held in my hand."

"Very clever, indeed," I expostulated, "but what became of the bullets I placed in that rifle? You deliberately fired at the lady."

"Granted, but I fired a blank cartridge. If you will pick up the rifle you will find that there are just as many bullets in it now as when you loaded it. You will also see that there are several rifles on the table which are identical. One of these contains blank cartridges only. This rifle is likewise fitted with a contact or circuit closing arrangement, passing from the trigger through rings on my hand (my usual procedure), thence down the legs to pins in the heels, as you will note." He lifted his foot to show the pins mentioned, which protruded about a half inch. "When I put the rifle aside for a moment seemingly changing the position of my fair accomplice, I managed, in coming back to the scene of activity, to exchange my rifle for the one loaded with blank cartridges, and fitted with the contact making arrangement. It is obviously impossible to make a mistake in this manner, because the first thing I look for is the electrical device and also for the metallic lugs which I securely put in contact with the rings on each hand, so as to make sure that the device will not fail. Wires from the rings lead up the arm and thence to the carpet via the shoe pins. The rifle being filled with blanks permits me to eject the cartridge when I so desire, or fire repeatedly, if the electrical device does not operate properly the first time."

NIGHT WEATHER VANE ILLUMINATED

An illuminated weather vane to assist aviators to make night landings has been perfected by the navy and tested successfully. It will be used by the Post Office Department when it inaugurates night flying on the transcontinental air route.

Inability to judge the distance from the ground and ignorance of the direction of the wind are the two chief difficulties in making landings at night. The first has been met by lighting up the landing field. The new weather vane meets the second. The vane has a red light at the arrow head and a green light at the other.

The Warship of 1950

By GRASER SCHORNSTHEIMER

(*Continued from page 749*)

as four of these small planes. And the plane will become even more important as an auxiliary to the battleship in the future. The tremendous strides of modern ordnance, particularly of naval ordnance, is setting future battle ranges beyond man's vision. But these ranges will not be beyond the vision of the spotting plane which will be in constant communication with the battleship by wireless.

Mines are of great importance. To the end of stopping an enemy's pursuit of wounded craft, every ship of the future will carry a quantity of stern mines of the contact type. When a ship is fleeing they will be dropped overboard to force the enemy to turn aside to avoid them and thus lose his quarry.

The capital ship of the future can not altogether denude herself of modern armor protection, as she will need it in close range encounters in foggy weather, etc. The belts will have to be left in place and sloping decks of light armor will have to remain to reinforce these belts.

Do not underestimate the value of armor. When the British said that speed was armor, everyone believed them but the Germans. The Germans armored their great battle cruisers. The result was that three great British battle cruisers went down in ten minutes of battle, under a bombardment of 11 and 12-inch shells, while German battle cruisers were able to withstand nearly fifty shells of from 13.5 inches to 15 inches. There is a proper defense for every form of offensive power.

Mountain Air Piped to City

(*Continued from page 739*)

throughout the city, subway stations will be turned into cool air oases where the weary travelers may find refreshment; consequently a natural beauty which will not take up very much space will constantly meet the wayfarers' eyes as they rush about their business.

The air passing through this immense aqueduct serves another purpose, namely that of aerating the water, and from time to time pocketing arrangements in the supply pipe will cause the water to be thoroughly aerated by its original invigorating atmosphere. City water supply will be still further improved and, instead of an expense, the air sold by the city to the various theaters would be clocked off by a meter and become a source of revenue.

The engineering feat is very simple indeed, and inasmuch as all the piping facilities are already in use, serving a different purpose, it becomes a simple matter to seal up present air vents and merely add the aspirators and air locks. The revenue afforded to the city populace the year around is well worth the low cost of the original installation.

There is, however, one grave difficulty which must be contended with. At the present time, the gravity conduit system from the mountains to New York City interrupted here and there by means of siphon-piping systems and a reservoir or two, carry ninety to ninety-five per cent of their full capacity of water. This means that very little air could be piped down to New York with the systems now used, but inasmuch as additional conduit facilities are being built, so that the present installations could work to about fifty per cent of their full capacity, the system would not interfere with the future supply of water. In different cities where water is obtained by conducting the same through channels to supply certain sections, and where these channels are only half full of water at all times, such a method becomes highly practical. Where inverted

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siphons are employed, in such places as beneath river beds and creeks, air by-passes with venturi tubes at their distant ends would have to be resorted to. These by-passes in the form of pipes could be suspended beneath wooden suspension bridges. When the air has reached the city, old gas tanks could be used to store it, as little of it would be used between the hours of 11:00 p.m. and 9:00 a.m., except on very hot days.

THE LABOR OF THE TIRES

The right rear tire gets the hardest usage, as I have mentioned before. The left rear tire ranks next; then the front right one—the left front one having a relatively easy life. And this is the way of it all: We take the right side of the road. Often the wheels on the left side will be rolling on smooth surfaces while the rights are bumping the bumps, off on the edge and in the gutter. This bumping wears the rear right tire most, but the rear left shares with the rear right the brunt of power and traction, not to mention sliding. The front right helps its rear partner carry the extra load that habitually falls on that side of the car. The left front, comparatively speaking, has little to do but roll. Therefore, change your tires so as to distribute the wear. It will conserve the labor and materials that go into tires. It will lessen your troubles and maintain the filling of your pocketbook.—F. H. SWEET.

TICK-LESS CLOCK

The tickless clock is one of the boons promised humanity through the discovery of a German scientist who has been delving in the field of oscillation. A selected audience of government officials, scientists and newspaper men today witnessed a demonstration of inventions of this nature perfected by an engineer, Heinrich Schieferstein, head of the Laboratorium für Sshwingungestechnik of Berlin.

A noiseless timepiece, operating without a lever, was one of a number of specimens which Herr Schieferstein used to show the technical importance of oscillating power for high-speed power engines and in the propulsion of ships, airplanes and gliders. A German-American corporation has been founded in Berlin for the purpose of world-wide exploitation of these discoveries.

The demonstration was featured by the use of an oscillating motor which is said to be the first synchronizing motor perfected, producing vibrations of a connected flap or disk synchronously with the movements of the motor. The promoters assert that the inventions mean a great saving in power.

Herr Schieferstein hit upon his new idea through studying the manner in which the oscillating currents in wireless transmit energy to one another.

IGNITION OF COAL DUST BY ELECTRIC ARCS

The extensive use of pulverized coal for fuel in industrial plants gives interest to tests recently made by the United States Bureau of Mines, which proved that coal dust suspended in air can be exploded by electric arcs under conditions that might prevail in a pulverized coal plant or in a coal mine. If there is electrical machinery in places where coal dust is apt to collect in quantities capable of producing a dust cloud, such electrical machinery should be housed in compartments designed especially for use in dusty atmospheres. Under Schedule 2B, the Bureau of Mines is prepared to conduct investigations looking toward the safety of electrical equipment for this class of service. Details of tests of the ignition of coal dust by electric arcs are given in Serial 2365 just issued by the Bureau of Mines.

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Radio Tuning Devices and Circuits

By A. P. PECK

(*Continued from page 773*)

when the tube is in oscillation. In other words, when the operator of such a set puts his tube in oscillation, part of the energy developed by the tube is re-radiated, and may be heard in a nearby receiving set in the form of a shrill whistle. For this reason the apartment house dweller and those who live near other amateurs (and who doesn't in this era of radio?) should avoid this type of set.

In Fig. 7 we see the old standby style of short-wave regenerative tuner. This utilizes two standard type variometers and a variocoupler. The latter may be either of the 90° or the 180° style. In this circuit the vacuum tube is made to regenerate by tuning the grid and plate circuits to resonance, at which time they will produce beats in the tube and cause it to regenerate or amplify at audio frequencies. This circuit is probably one of the best all-around short-wave receivers, and has the additional advantage that it does not re-radiate. Some amateurs use a regenerative circuit somewhat similar to this with the exception that the variometer in the grid circuit is omitted. This, however, is not as satisfactory as when the grid-variometer is used, as it does not regenerate as easily and continuously as the latter. Another variation is to put the grid-variometer in the antenna circuit; that is, in series with the aerial. In the circuit illustrated a variable condenser could be used to advantage in series with the antenna. This will give more selective tuning to the primary circuit, but, on the other hand, will complicate the tuning somewhat.

The next type of tuning apparatus we will consider will be honeycomb coils. It may be well to mention here that other types of compact inductance coils, such as spider-web coils, will also work in these circuits. In Fig. 8 two coils are used in variable inductive relation to each other, and the circuit is very similar to that of a loose coupler. There are various types of mountings on the market which may be used to hold the coils in this relation. Whatever kind is used, the coupling between the two coils must be capable of constant variation in an easy manner. It should be no hard task for an amateur who is at all handy with tools to construct a mounting of this type. Coming back to the circuit in Fig. 8, the reader will find that a variable condenser is shown in series with the antenna. This method of tuning the primary should be tried, as well as that in which the condenser is shunted across it.

In Fig. 9 is a type of regenerative tuner which will allow the reception of radio messages over all the wave-lengths in common use to-day. The action is very similar to that of circuit of Fig. 6, with the exception that the primary and secondary are coupled inductively, while in the former the primary of the vario-coupler is used as an auto-transformer. In Fig. 9 the feed-back is accomplished by coupling the plate and secondary together. The same holds good for the mounting of the coils and the connection of the primary condenser in this circuit as in Fig. 8.

In closing, we wish to give one bit of advice to all who are really interested in radio and wish to see it progress. That is *experiment*. Try different circuits and combinations of circuits, and, above all, keep notes of everything you do. Many a good piece of information has been lost to one because he trusted to his memory, only to be rediscovered by someone else who kept notes and profited thereby.

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down, think it over and work it out on paper. After you have done this, trace out all the connections and see that nothing is short-circuited. Also, if it is an audion hook-up, see that the "B" battery is where it belongs, and not connected in such a way that it will go through the filament when you turn a switch or if one of the variable condensers should happen to short.

After you try out some circuit which you were sure would work and you find that it does not, don't be discouraged, but go right on and try again. If you do get good results, don't be satisfied, but try for better results. This is just what Major Armstrong did. He worked out the regenerative circuit which gave wonderful results, but he was not satisfied, and the result of his dissatisfaction is the Armstrong super-regenerative circuit.

The Autobiography of an Explosion

By Prof. LINDLEY PYLE

(*Continued from page 751*)

is displaced laterally by the action of the charged plate. The key S is opened immediately after the explosion. Data for plotting the variation of pressure with time can be easily obtained from the curve appearing on the developed plate. A typical photographic record is reproduced in Fig. 4.

Fig. 5 is a pressure-time plot of an explosion of hydrogen and oxygen prepared by electrolyzing water. (The statement that one centimeter displacement is equivalent to 220 pounds per square inch is justified by an initial experiment in which air was forced into the explosion chamber and the pressure read from a gauge simultaneously with the corresponding displacement of the point of impact of the electron jet against the photo plate.) The effect of mixing air with the explosive mixture is clearly shown. The peak of the pressure is not only lessened but is delayed in development. In practice this might be desirable. For a pure explosive mixture the maximum pressure is attained in half a thousandth of a second.

In order to study the explosive wave in water due to submerged charges of gun cotton and of T. N. T., the lid JK of the crystal container indicated in Fig. 1, was removed and the pot filled with vaseline. The pot was then lowered to a depth of several feet in the water where the explosion was to occur. To measure the velocity of transmission of the explosion wave two detecting vessels of crystals were used. The vessels were placed 24 feet apart at the same depth and the explosive set off 12 feet from one of them and in the same straight line connecting the vessels. Both sets of detecting crystals were connected to the same plate M of the registering apparatus which was housed on the shore. Fig. 6 is a typical record obtained with gun cotton.

In Fig. 6, A is the plotted data registered by the first set of crystals, C for the second set. (Vessel C was more sensitive than A, having a greater amount of crystals.) Evidently the wave traveled the distance between the two sets of crystals (24 feet) in 0.005 second, the velocity of the explosion wave being 4,800 feet per second. The pressure recorded in curve B was due to the explosion wave that traveled to the first detecting vessel by way of the bottom of the body of water used in the test. The reflected wave recorded by the second vessel is not shown in the diagram.

Applications of this new experimental method to gas engine practice and in other fields are awaited with interest.

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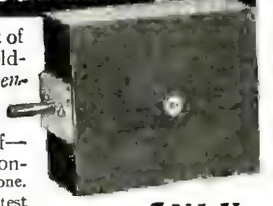

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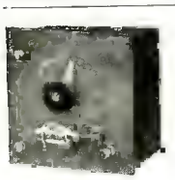

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Radio for the Beginner

By ARMSTRONG PERRY

(*Continued from page 776*)

To illustrate the method of handling information by radio, take the weather forecasts. We could just as well take the stock market reports, the market quotations on farm products or any other class of information. Since one person out of every hundred in the United States is a government employee and in a position to gather information, and since the Federal government owns and operates over two hundred radio stations in the United States and can reach every nook and corner of the country with its broadcasts, we can have any information we ask for.

The reports on which the Weather Bureau bases its forecast of the weather you are going to have in your town for the next forty-eight hours will be gathered at eight o'clock tonight. At ten o'clock tonight forecasts will be transmitted from a number of government radio stations, each one covering the territory reached by the transmitting station. NAA, the navy station at Arlington, Virginia, for example, will give detailed forecasts for all the districts east of the Mississippi.

In the meantime, of course, the distribution of the forecasts by wire and mail begins. Your local paper may receive them by telegraph tonight. You may get the paper by seven o'clock in the morning. But by radio you can get them within two hours of the time that the local observers report to the Weather Bureau.

What difference does it make? Think!

Did you never hear a farmer, looking over a field of mown hay all but ruined by a thunder shower, say: "Jingo, I didn't think it would catch me like that!"

Did you never hear a merchant say, on the rainy day when his big sale fizzled and he lost the fruits of a month of hard work: "Hang it, why does it always have to rain on the day when you've got something special on?"

Did you never hear a child sob as it pressed its nose against a windowpane upon which the rain was beating: "Mamma, why didn't they have the picnic yesterday?"

Did you never get on your rubber boots and search the flats with the rest of the neighbors for the body of the husband and father whose barn went down in the freshet while he was attempting to rescue the family live stock?

Not a day passes without its calamity due to the failure of someone to take advantage of the quick information that radio might bring.

There may be no more spontaneous demand in your town for up-to-the-minute weather reports than there was for umbrellas when Noah laid the keel of the ark, but a radio novice could create a demand and supply it.

The first step is to get the forecast. Some government stations send them in code and some by radio telephone. If the only stations you can hear use code, the game is to get hold of someone who can read code. Few towns are without some amateur who can copy these forecasts. Usually there are enough of them so that by arrangement each can take one or two days a week. It requires only fifteen minutes to get the weather.

The next step is the local distribution. Most towns have at least one radio amateur who operates a transmitting station. If he uses a radio telephone transmitter it is a very simple matter for him to repeat the forecast at a specified time, say 10:15 p.m., so that all who have radio receivers may hear it. If he transmits only in code, he can send it slowly enough so that a novice

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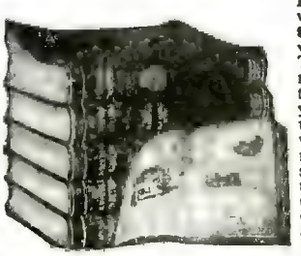

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Since the proportion of radio users in the population is not yet as large as the percentage of government employees, radio distribution alone will not reach everybody. It must be supplemented by wire service, messenger service, bulletin board service and publication. The radio man who sets out to organize the service, if he has a telephone, can readily call up other citizens and arrange for regular daily reports for those who can be interested in them. Whole strings of farmers on rural routes can be reached by one call with a weather report as easily as with private information not intended for more than one of them.

For messenger service the Boy Scouts and other boys are available. In fact the Scouts could help a good deal on the radio end, if local encouragement were offered. A boy on a bike could cover a good sized community in a short time, posting copies of the forecast on bulletin boards, delivering copies to local papers, and leaving copies at the homes of citizens who had agreed to assist with further distribution. The more workers there are in the system the more fun they will get out of it and the more popular it will be.

To be entirely successful, local radio service needs the boosting of a strong local organization. Suppose you should interest your local Chamber of Commerce, Board of Trade or Rotary Club in radio service. Immediately committees would be appointed to find the radio amateur who could copy and re-broadcast the broadcast from government stations; to list the home receiving stations and find out how many would be willing to receive the broadcast when it was re-transmitted and pass it along the radioless families in their neighborhood; to get the co-operation of the Boy Scouts or other organizations willing to provide messenger service, to secure the publicity to wake the public up to their opportunity. Right now any town that would put into operation a complete receiving and local distributing service would make itself nationally famous, and national fame has brought to many a town a prosperity that it would never have known if it had mulled along singing that soothing little Sunday School hymn: "You in your little corner and I in mine."

Furthermore, a local Chamber of Commerce could promote, through the United States Chamber of Commerce or by other means, a national demand for government radio service that has not as yet been established. We have representatives in every land as well as in every town and city in our own land. If there is any information we want that is not now in the air our government can soon put it there.

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Detailed information concerning broadcasts from government stations is published in the Radio Service Bulletin (monthly, 25 cents a year), the List of Government and Commercial Radio Stations (25c) and other publications that can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, etc., required by the Act of Congress of August 24, 1912, of SCIENCE AND INVENTION, published monthly, at New York, N. Y. (Jamaica, New York), for Oct. 1, 1922.

State of New York, County of New York, ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of SCIENCE AND INVENTION and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Experimenter Publishing Co., 53 Park Place, New York City; Editor, Hugo Gernsback, 53 Park Place, New York City; Managing Editor, Harry Winfield Secor, 53 Park Place, New York City; Business Manager, R. W. DeMott, 53 Park Place, New York City.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) Experimenter Publishing Co., Hugo Gernsback, Sidney Gernsback, H. Winfield Secor, R. W. DeMott, Dr. T. O'Conor Sloane, Mrs. Catherine Major. (All of the above of 53 Park Place, New York City.) M. M. Finucan, 720 Cass St., Chicago, Illinois.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

H. GERNSBACK.

Sworn to and subscribed before me this 22d day of September, 1922.

Joseph H. Kraus, Notary Public, Queens County Register's No. 2951; New York County Register's No. 3337; New York County Clerk's No. 439. (My commission expires March 30, 1923.) (Seal.)

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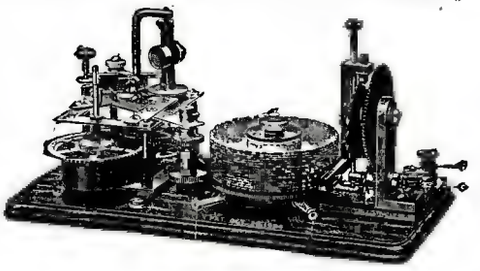

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Book Review

(Continued from page 789)

A LIFE OF GEORGE WESTINGHOUSE. By Henry G. Prout, E.C. Hard covers, size 9"x6". Published by The American Society of Mechanical Engineers, New York City.

Colonel Prout has long been identified with railway literature, as editor of the *Railway Gazette*, and writer therein. In this work describing the really remarkable work done by Westinghouse, the great railway inventor, the writer has neglected no phase of his character, and has given a fairly complete resumé of his many inventions. Westinghouse has done a great deal which is little known, and this book in telling of his work in so many side lines, if we take his railway work as a trunk line of his inventions, is wonderfully suggestive and it would seem not too much to say that he began many things never carried to a conclusion, which could still be followed out and brought to valuable completion, now that the great originator is no more. A list of his United States patents covers over eight pages of rather fine print, a wonderful exhibit. Turning over the pages rapidly, studying the great range of subjects covered, and the personal opposition which an inventor has to overcome, it would appear that it was not only genius which brought him to the summit of his fame, but persistence to the last degree. Interesting illustrations and portraits are also given.

POWDERED COAL AS A FUEL. By C. F. Herington, M.E. Hard covers, size 5¾"x9½". Published by D. Van Nostrand Co., New York City.

This book, emanating from the well-known house of D. Van Nostrand Company, treats of one of the advanced methods of burning coal directly. Fuel gas, involving the necessary waste in the production of producer gas, in some ways appears more advanced than direct combustion of lump coal, but when the coal is brought to the powdered condition, and burned as such, we seem to have combined the efficiency due to unimpaired calorific power of the entire coal, with the ductility, if we may use such an expression, of the gaseous fuel. Mr. Edison has applied powdered fuel to his cement cylinders with considerable success, and all sorts of data as obtained by him and other engineers, are given in elaboration in the pages of the book under review. Some very practical tables and useful data are embodied. There is no question whatever that the solving of the fuel question should come to an early end, and such investigations and inventions as those detailed in "Powdered Coal as a Fuel," will lead to improved results, which will do much to ameliorate the fuel situation.

PULLING TOGETHER. By John T. Broderick. Hard covers, size 7¼"x5". Published by Robson and Adee, Schenectady, N. Y.

The recent strikes which have brought the United States to a condition of partial paralysis, indicate a strained relation between labor and capital, for which there is no good excuse. The folly of mankind, selfishness, and the high salaries of labor leaders and paid members of the organizations are poor reasons for such disturbances. This book is interestingly written, its theme being that employers and employees should pull together, somewhat like man and wife, although in the matrimonial relationship it is not always clear who is the employer or employee. Family life is greatly impaired by divorce, and what ought to be the family life of labor and capital wedded together is well nigh ruined by strikes, dictated and led by selfishness. But there is no Reno for labor and capital; they are like the Siamese twins who could not be separated without death to both parties. We cannot help believing firmly that in the future the true marriage of capital and labor will increase the happiness of both parties and their mutual understanding.

AT THE EARTH'S CORE. By Edgar Rice Burroughs. Size 7½"x5". Cloth covers, 280 pages. Published by A. C. McClurg & Company, Chicago.

The present scientific novel by the well-known author has for its theme the old hypothesis that the earth's interior is hollow. There is, of course, nothing new about this. As a matter of fact, Jules Verne's "To the Center of the Earth," written a generation ago, covers precisely the same ground as does Mr. Burroughs' book.

Jules Verne takes his hero down through an extinct volcano in Iceland, where they discover that the earth's interior is not of molten or cold matter, but that it is hollow and spherical in contour.

Burroughs does the same thing, except that he uses a machine, of which he does not tell us much, that bores itself through the crust of the earth for some 500 miles, and lands his hero on the inside surface. The hero finally returns *via* the same route, by reversing the machine, which brings him back to the surface of the earth.

In all other respects, Burroughs parallels Verne very closely. Verne, in his story, has his prehistoric monsters, prehistoric human beings, etc., and Burroughs has copied that idea pretty well. There is,

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of course, a stationary sun in the middle of the hollow sphere, in Burroughs' story, the same as in Jules Verne's, and all other scientific phenomena run closely side by side.

The present reviewer finds no fault with the book, except that as far as science is concerned, Mr. Burroughs is not anywhere near as thorough as M. Jules Verne, who always had plausible explanations, which were as a rule based upon scientific truths. Mr. Burroughs does not bother himself very much with such things, and he does not offer many scientific explanations.

For all that, Mr. Burroughs is a fascinating writer, and manages to hold one's interest in every page of the book,—even if slang creeps in here and there. However, the public is not concerned here with accurate scientific statements, and certainly takes to the pure entertainment which Mr. Burroughs knows so well how to give.

THE HARMONICS OF EVOLUTION. By Florence Huntley. Hard covers, size 5½"x8", 466 pages. Published by R. F. Fenno & Co., New York City.

This book is remarkable for its superior diction and its clear way in the majority of chapters of expressing the thoughts of the writer, who attempts to prove that life after death, or after what we know as death, persists. In fact there is a chapter on the impossibility of death. Being well read, Mrs. Huntley has reviewed in this work the principles of a number of interesting theories on evolution and Darwinism. The writer attempts to show that hypnotism and mediumship are one and the same, although she fails to conclusively prove this fact. The chapters on Natural Marriage, Legal Marriage, and Divorce, are worth consideration, but an attempt to explain True Marriage by means of mathematics and harmonics as is done by the author of this work, fails utterly in its desired purpose. We do not believe that marriage will be explained mathematically now or hereafter, even if eugenic marriages are to become a fad, but of course that is more or less of a personal opinion. For the spiritualist or psychologist this book is very valuable; grammatically it is superb. Chapters on Masculine Reason and Feminine Intuition, as well as the one on Masculine Will and Feminine Desire, make this book of particular value to the husband and wife.

MOTION PICTURE PROJECTION. By T. O'Conor Sloane, Ph.D. Illustrated, 303 pages. Hard covers, size 6"x9". Published by Falk Publishing Co., New York City.

This book, according to the fly leaf, is used as a supplementary text in the New York Institute of Photography. A very full list of the chapters and their contents appears in the front of the book, and an elaborate index appears at the end. It is a very adequate compilation of all work done in the motion picture field, beginning with motion picture toys and terminating with photography by means of the electric spark, including a few mathematics on electricity and electrical explanations as well as the care of electrical machinery. Unfortunately, the book is printed on two qualities of paper, probably because half-tone reproductions in fine screen would present a smudgy appearance if printed on the coarse stock used throughout the work. Consequently a super-coated stock is employed for these half-tone reproductions. For the operator who intends to understand motion picture machines from their inception, including the historical interest which these machines may have, this work is rather exhaustive; for the individual who is merely an operator at his station, only the latter half of the work need be seriously taken into consideration. The Simplex, the Hallberg and the Power machines are treated in great detail.

DYKE'S AUTOMOBILE & GASOLINE ENGINE ENCYCLOPEDIA. By A. L. Dyke, electrical engineer. Size 7"x10", leather cover. Published by The Goodheart-Willcox Co., Chicago, Ill.

This book, the thirteenth edition, has been enlarged and practically rewritten. The illustrations are all brought up to date, and cover various parts of all makes of cars. The text is such that it can be understood by the average car owner to whom it is a wonderful source of information. Facts are given of such range as to make the book a necessity for everyone genuinely interested in any way in the automobile world. The book is probably the only one of its kind which lays particular stress on the fundamental principles of automobiles, as well as on the details. Such subjects as storage batteries, starting motors, transmissions, lighting systems, etc., are treated exhaustively in such a way that anyone who reads it can easily find the troubles with his own car and, if he wishes, make his own repairs. This latest edition also presents the elementary principles of electricity and magnetism, so that the reader may be thoroughly informed on these subjects before he passes on to the more complicated electrical parts of his car. Motorcycles, trucks and airplane engines are dealt with, as are also Diesel engines, and farm electric lighting plants. A complete general index gives ready access to any particular part of the text desired, as it is very concise and well arranged. In the back of the book there are two skeleton charts of four cylinder engines, in which a car owner can fill in the parts of his own motor, thereby having complete drawings showing just how the cylinders of his particular make of machine are timed to fire, as well as the positions of the cam shaft, cam gears and valves. The chapter on motorcycles is quite complete, as it deals with the engines, ignition, carburetors and transmission of several standard types.

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You've heard your neighbor praise the Pathfinder, the wonderful illustrated news and story paper published at Washington for people everywhere. This paper is the **Ford** of the publishing world; has half a million subscribers. Chuck full of just the kind of reading you want. Unequaled digest of the world's news. Question Box answers your questions. Stunts for children; real fun for all. Exciting serial story starts soon. Send 15 cents (coin or stamps) today for this big $1 paper 13 weeks. You will be more than pleased.
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YOU can make $15 to $60 weekly in your spare time writing show cards. No canvassing or soliciting. We instruct you by our new simple Directograph system, pay you cash each week and guarantee you steady work. Write for full particulars and free booklet.
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"STANDARD" VARIABLE CONDENSERS

				Assembled	Knock-down
11 Plate	Cap'y	.0002 5	M.F.	$2 35	$1 85
23 "	"	.0005	M.F.	2 85	2 25
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"Owl" Rheostats $1.00

We ship, postage prepaid, upon receipt of price
All "Standard" Products are Fully Guaranteed.
STANDARD APPLIANCE MFG. CORP., 432A East 71st St., N.Y.C.

LEARN AT HOME DURING SPARE TIME
Write for book, "How to Become a Good Penman," and beautiful specimens. Free. Your name on card if you enclose stamp
F. W. Tamblyn, 424 Ridge Bldg., Kansas City, Mo.

You can be quickly cured, if you
STAMMER
Send 10 cents for 288-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering 20 yrs. **B. N. Bogue, 789 Bogue Bldg., 1147 N. Ill. St., Indianapolis.**

"Comb. Contest" Awards

(*Continued from page* 757)

Midland, Mich. The uses of this jack-bumper are many. Two of these devices are placed on a car, one in the front and the other in back of the machine, in such a way that at night the working parts of the jack will be illuminated by the headlights of the car. The jacks serve as a bumper which can be separated so that the machine will be equipped with four individual jacks, any or all of them being used to raise the car, or the individual wheels of the car. Should the car become stuck in the mud or sand, it can be jacked up sufficiently to place a board beneath the wheels. Inasmuch as the operator stands erect when jacking up the car, there is very little danger of soiling the clothes. Dr. Sjolander furnished some very excellent photographs of his device.

FOURTH HONORABLE MENTION

The fourth honorable mention is for a comb and brush combination patented by Frederich L. Tate, of 1043 Pacific St., Vancouver, B. C., Canada. The comb slides inside of the brush in this device, so that the comb or the brush may be used independently of each other, or both could be used together.

FIFTH HONORABLE MENTION

Cecil Bugh, of Leachburg, Pa., submitted an interesting combination scissor, which was arranged so as to fold. This scissor had upon one of its blades a tip for cleaning nails, and a fine file for shaping them. The other blade of the scissor was equipped with an ebony point for pushing back the cuticle around the nail, the edges of the scissor being sharp, of course, to permit trimming the nails. Attached to one of the handles was a buffer and nail polisher.

SIXTH HONORABLE MENTION

It is quite evident that the judges in this contest awarded prizes for the best suggestions in the order of their relative value, because although there were thousands of manuscripts to choose from, Mr. Butz, already with two awards to his credit, obtained the sixth honorable mention for a tooth brush with a hollow compartment in the handle containing a coil of dental floss. This combination would encourage users of tooth brushes to employ the very efficient dental floss. Teeth cannot be thoroughly cleansed unless both floss and tooth brush are used during the toilet.

In closing we would state that there were a great many more foreign and Canadian entries in this contest than in many heretofore, although the fairer sex did not turn out as well this time as they did in the Perpetual Motion Contest, closed in the last issue. We are indeed glad to see that readers residing in Canada are ambitious to try for the awards. The degree of success attained may easily be learned by glancing over the number of prizes and honorable mentions awarded to residents of our sister country.

---

10 MILLION AUTOS IN U. S.; EXTEND FOR 20,000 MILES

If all the automobiles in the United States were to take to the road at the same time, end to end, the line would extend four-fifths of the distance around the world at the equator, or seven times from New York to San Francisco.

President George C. Diehl, of the American Automobile Association, states there are 10,600,000 cars in the United States, which, if stretched end to end, would extend 20,000 miles.

Student Winding a Stator

Learn Electricity In 3½ Months

THE whole world of electricity is open to the Coyne trained man. He is trained completely. He can make big money as Power Plant Operator, Superintendent, Telephone man, Construction worker, auto, truck or tractor electrician, battery man, radio expert, or he can go into business for himself as electrical contractor, dealer, auto ignition or battery expert and make from $3,000 to $20,000 a year. Hundreds of our graduates today are making big money and you can do the same if you grasp this opportunity—act now.

Big New Home of the Great Shops of COYNE

The increased popularity of Coyne and a tremendous influx of new students simply forced us to move into larger and more spacious quarters. Here, in the big, new home you will find added electrical equipment—new and larger departments—a more complete electrical training.

Earn $150 to $400 Per Month

No books or useless theory. You are trained on $100,000 worth of electrical equipment. Everything from door bells to power plants. You work on motors, generators, house-wiring, autos, batteries, radio, switch-boards, power plants—everything to make you an expert ready to step right into a position paying from $45 to $100 a week. Learn electricity in the electrical center of the world. Send coupon today for a free catalog

Radio Course FREE

We include the following free with the regular course:

(1) A complete course in auto, truck and tractor electricity and storage batteries. Greatest outlay of auto electrical and battery equipment in the country.

(2) Course in Radio—the marvel of the age. Constructing, installing and operating. You can build you own wireless telephone set.

(3) A life scholarship in the Coyne school. You can stay as long as you wish and return for further training at any time in the future.

EARN WHILE YOU LEARN. *We help students to secure jobs to earn a good part of their expenses while studying.*

Send Coupon Now!

Don't delay a minute—send that coupon in right now for our big free catalog and full particulars of this wonderful offer. Act now!

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Coyne Trade and Engineering School
Dept. 5339, 1300-1310 W. Harrison St., Chicago, Ill.

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Dear Sir: Please send me free your big catalog and full particulars of your special offer of two extra courses.

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RADIO SERVICE PRODUCTS

The Acknowledged Standard of the Radio Amateur

PRICE $8.50 *(Patent Applied For)*

The

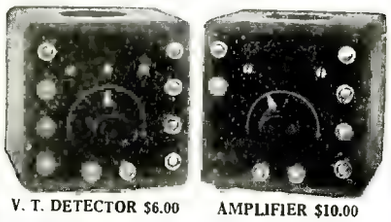
AMPLITRON

(A Real Loud Speaker)

At the new low price of $8.50. Has met with success everywhere. Reproduces radio phone speech and music without distortion—equally good for code. Clear and distinct. No exciting batteries or adjustments necessary. Uses a Baldwin Type "C" single phone.

Price *(as illustrated)*..... **$8.50**

Price *WITH BALDWIN PHONE AND CORD.* **$16.50**

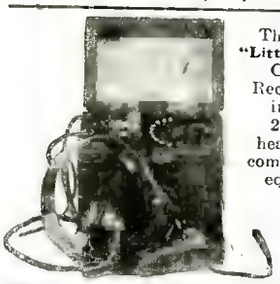


V. T. DETECTOR $6.00 AMPLIFIER $10.00

Midget Type Detector and One-Stage Amplifier, size 4½" x 4½" x 4½", Formica Panel, Oak Cabinet, interior construction equal to high-priced instruments.

Tubular Grid Leaks (.2, .5, 1.0, 1.5, 2.0, 3.0 megohms) **$0.65 each**
Tubular Grid Leaks mountings..... **.35** "
Single V. T. Sockets Type S-10 $0.90
Triple V. T. " " S-4 2.70

"The Standard Radio Guide, tells you how to enjoy Radio at home, and the price is only 50 cents postpaid."



The original **"Little Wonder"** Complete Receiving set, including 2000 ohm headset and complete aerial equipment

$15.00

Remittances for direct orders should be made by Post Office Money Order to Sales Division. Liberal discounts to dealers.

RADIO SERVICE & MFG. CO. (Est. 1918)

Sales Division

507 Fifth Ave., N. Y. C.

Factory: Lynbrook, L. I.

SUPER-LOCOMOTIVE

A new locomotive, the most powerful of its type, is being used experimentally on the New York Central lines. It is the first to combine new features of construction which have been tried out on a number of engines. It delivers more power for its weight than any other locomotive in the world, and produces more energy from each ton of coal. Much of the drudgery of running a locomotive is performed in the new model automatically.

The new locomotive is equipped with a *booster*, which turns the trailing wheels into driving wheels, thus adding 26 per cent. to the driving power. The *booster* can be readily adjusted and may even be connected up automatically when needed. Heretofore, the trailer wheels have only carried the weight of the rear part of the engine. The device consists of an auxiliary engine which is geared to the axle of the trailer. The weight of the engine has been considerably reduced by using alloy steel and hollow axles. It weighs 334,000 pounds. The tender carries 10,000 gallons of water and sixteen tons of coal.

GEOPHONE DETECTS COMPRESSED-AIR LEAKS

A new use for the geophone, the detection of leaks in compressed air lines, is described by the United States Bureau of Mines in Serial 2380. Experimental work in Arizona metal mines demonstrated that leaks in compressed air lines buried under several feet of earth could be successfully located. The delicacy of the instrument for listening purposes is now well demonstrated, says the Bureau. Obviously, the geophone will be found useful for many purposes in locating invisible unknown sources of vibration that transmit sound waves detectable by delicate instruments. The Bureau of Mines has recommended the use of the geophone for locating quickly faces of approaching workings where signaling by pounding on rock faces can be done; for locating mine fires; for locating entombed men; and for leaks in buried water mains. It is believed that many other practical uses will be developed. The geophone used by the Bureau of Mines is an approved type of the French military geophone.

STEINMETZ DESIGNS NEW ELECTRIC AUTO

The first model of an electric automobile designed by Dr. Charles P. Steinmetz of the General Electric Company was recently completed.

The car will travel 200 miles without having its batteries recharged, will attain a speed of 15 to 40 miles an hour, weighs only 2,000 pounds and is economical in maintenance. It will sell for $1,000 or less.

GLIDER EASILY SOARS TOWED BY SEAPLANE

A sailplane designed by Glenn H. Curtiss was successfully towed through the air over Manhasset Bay recently by a Curtiss biplane of the "seagull" type. Starting from Port Washington, L. I., the glider, weighing about 140 pounds, was drawn across the bay, gliding down to the water after disconnection from the airplane.

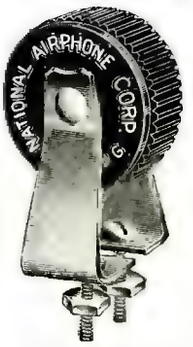
David H. McCulloch piloted the glider which was attached to the seaplane by a wire about 800 feet long. The plane taxied across the smooth water for a short distance and the glider quickly mounted into the air. The biplane followed suit, reaching a height of about 125 feet, while the towed glider rose to about 200 feet. When the glider was close to the opposite shore the wire was disconnected and McCulloch brought his tiny craft down. Officials of the navy and army watched the experiments, which were conducted to provide some sort of glider target for aerial gun practice.

A Revolution in Radio Receiving

NATIONAL AIRPHONE GOLD GRAIN DETECTOR

Guaranteed Fool-proof

Brings Joy to Every Crystal User
An Absolute Necessity
For All Crystal Sets



For Panel Mounting (Patents Pending)

PRICE $2.00
Actual Size

with Brackets and screws for panel mounting.

This Detector is not a fixed detector but a revolving one. Instead of a cat-whisker, several hundred grains of pure gold are used for contact. Is always ready and Stays-Put. Most sensitive point of the detector is found by revolving the cartridge slightly while tapping.

After you have fussed with cat-whiskers, springs, balls and adjusting handles, and after you have become almost a nervous wreck hunting for the "elusive spot," you will welcome with open arms our

100% FOOL-PROOF "GOLD-GRAIN" DETECTOR

Awarded certificates of Merit by Institutes of New York Eve. Mail and New York Tribune.

National Airphone Outfit $12.50

NATIONAL AIRPHONE CORPORATION
REG U S PAT OFF.

16-22 HUDSON STREET NEW YORK

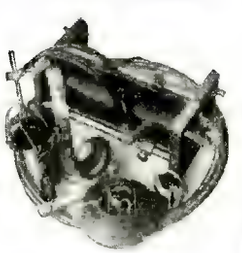
Dealers—Write for Prices

RADIO SET AT CUT-RATE

Special Xmas Offer

$8.75

FOR A



Heclo Radio Outfit

Complete Radio Set, including 2000 ohm double headset, double-slide tuning coil, phone condenser and aerial—everything necessary for the full enjoyment of the wonders of wireless, without the use of batteries or any other apparatus.

Full Instructions Given

Complete instructions furnished so that anyone can set up and operate. Aerial can be put up indoors, if desired, by attaching to the moulding of a room. Receives concerts, stock and weather reports and news speeches within 25 to 50 mile radius—and code messages from ship and shore stations as far as 300 miles. Double-slide coil and glass-enclosed detector insure very clear reception. All exposed metal parts nickel-plated. An extremely practical high-grade set for amateurs and others. *Send for it today at this special cut-rate Xmas price—$8.75 postpaid.* (West of Denver, 25c extra.) Additional 2000 ohm double headset for $4.50.

HECLO RADIO COMPANY
Dept. 10, 1745 Brush St., Detroit, Mich.

Junior Detector Units

For the amateur, and also the rapidly growing commercial field, we have developed an entirely new line of apparatus, in which is incorporated the very latest advancement of the science of Radio.

Each individual unit is primarily a separate and distinct device, complete in itself, yet by adding one to another any combination may be obtained, from the simple crystal detector through all the stages of radio-frequency and audio-frequency amplification.

Seasoned knowledge and experienced handicraft are built into these units—the product of a plant and an organization whose history in Radio dates back to the earliest days of "wireless."

The instrument illustrated is undoubtedly the best type of crystal set ever offered.

Its Special Features Include:

High grade 21-plate condenser.
Device for locking catwhisker into positive position after live spot is obtained. No jarring or vibration of the set can destroy this positive contact.
Range 150 to 600 meters, which may be increased to 12,000 meters by attaching loading coils.

Signal Crystal Detector Type 110

Space forbids complete description. Send for our Booklet and Special Bulletins. For certainty of Radio results insist on SIGNAL parts and sets. For sale by dealers everywhere.

(1898)

SIGNAL Electric Mfg. Co.

Factory and General Offices
1191 Broadway, Menominee, Mich.
Atlanta, Boston, Cleveland, Chicago, Minneapolis, Montreal, New York, Pittsburg, St. Louis, San Francisco, Toronto
You'll find our local address in your Telephone Directory

Coupon for Guide to Radio Satisfaction

Please send, without obligation, your interesting book about SIGNAL parts and sets, to the name and address written in the margin of this page.

The RADIOGEM

(Patents Pending)

$1 Receiving Set—The Simplest Radio Outfit Made—Yet as Practical as the Most Expensive! $1

You need know absolutely nothing about wireless to operate and enjoy the RADIOGEM. It is so sturdy, so simply constructed that it is small wonder radio *engineers who have tested* it have pronounced the RADIOGEM a brilliant achievement. The RADIOGEM is a crystal radio receiving set for everyone at a price anyone can afford.

Why The RADIOGEM Can Be Sold For Only $1

Here's the secret: The RADIOGEM Construction eliminates all unnecessary trimmings, cabinets and the like, which do not play any part in the operation of a set. You receive the RADIOGEM unassembled, together with a clearly written instruction book, which shows you how to quickly and easily construct the set, using only your hands and a scissor. The outfit comprises all the necessary wire, contact points, detector mineral, tube on which to wind the coil, etc., etc. The instruction book explains simply and completely the principles of radio and its graphic illustrations make the assembling of the RADICGEM real fun. Remember the RADIOGEM is a proven, practical radio receiving set and will do anything the most expensive crystal set will do.

The RADIOGEM is the Prize Winner of the Age

Out of hundreds of radio models submitted recently in a great nation-wide contest, radio engineers, the judges, unanimously chose the RADIOGEM as the winner—the simplest radio-receiving set made! And the RADIOGEM costs you nothing to operate; no form of local electricity is required.

DEALERS The RADIOGEM is the wonder item of the radio age. It is storming the country, for the RADIOGEM'S price is so low everyone is able to buy one. Write immediately for full particulars before that shop across the street beats you to it.

Hear the programs of the Broadcasting Stations on the RADIOGEM

$1 *Without Phone or Aerial*

Receives up to 20 Miles

The RADIOGEM CORPORATION
42-R HUDSON STREET
NEW YORK CITY

The Ideal Xmas Gift

Make it the GREATER Radio Christmas

THIS year the message of Christmas will flash one inspiration over all lands and to all peoples — no frontier can turn back the swift messenger, Radio, whose steed keeps pace with light.

The gift of all gifts is Magnavox Radio, the Reproducer Supreme: the gift that will mean most to every member of the family, old and young.

Let Magnavox bring you daily the world's news and entertainment — the greatest victory of science, the greatest opportunity of art.

MAGNAVOX

R-2 Magnavox Radio with 18-inch horn: this instrument is intended for those who wish the utmost in amplifying power; for large audiences, dance halls, etc. $85.00

R-3 Magnavox Radio with 14-inch horn: the ideal instrument for use in homes, offices, amateur stations, etc. $45.00

Model C Magnavox Power Amplifier insures getting the largest possible power input for your Magnavox Radio.

2 Stage AC-2-C . $80.00
3 Stage AC-3-C . 110.00

When you purchase a Magnavox product you possess an instrument of the highest quality and service.

Magnavox products can be had of good dealers everywhere. Write us for copy of new illustrated booklet.

THE MAGNAVOX CO.
Oakland, California
N. Y. Office: 370 Seventh Ave.

MAGNAVOX Radio
The Reproducer Supreme

SUN'S ELECTRIFIED DUST

PROFESSOR J. A. FLEMING gave the fifth Henry Trueman Wood lecture before the Royal Society of Arts in London recently. "The Coming of Age of Long-distance Wireless and Some of Its Scientific Problems."

It has been proved, said Dr. Fleming, during the last 20 years that the received signals at distances of 6,000 to 12,000 miles were many thousands, or even millions, of times stronger than could be accounted for by pure diffraction or bending of the waves around the earth. It was generally agreed that long-distance wireless telegraphy only took place in consequence of the existence of an electrical conducting layer in the earth's atmosphere. This was present at a height probably of 100 to 200 kilometers, and was thought to be due to electrified dust which came from the sun. The outstanding problem of long distance wireless telegraphy and telephony was the neutralization of the effect of vagrant waves on the receiving apparatus.

MAKES EACH PHONE A RADIO RECEIVER

Telephones in Everett, Washington, already equipped with a device which measures conversation, are to be made into wireless receiving stations through the use of an attachment supplied by the telephone company.

To hear concerts, news bulletins and other features radiated by broadcasting stations of Seattle, thirty miles away, Everett radio fans who also are telephone subscribers will simply hook their radio receiving sets to the attachment, which is known as the radio adapter, and which will fit into the telephone bell box. Expensive aerials and wiring will not be needed.

In addition to supplying the adapter the telephone company working with the Seattle Radio Association, will mail to its radio subscribers weekly programs of the broadcasting stations and will collect $5 a year from each subscriber to defray the cost. The Seattle Association hopes to have telephones in all other cities within a radius of 100 miles equipped with the adapter.

OIL ON RIVER ROUTS FOG

A large section of Pittsburgh fog was completely put out of business recently by local scientists, assisted by officials of the Weather Bureau and experts from the United States Engineering Department.

The initial experiment, conducted on the Monongahela River, was pronounced a distinct success.

The experiment consisted of coating with oil the Monongahela River from Rice's Landing to a point one and one-half miles upstream.

Notified by the Weather Bureau that a cold wave would sweep through the valley, scientists took the government boat Evelyn, a derrick and a barge fitted with sprinkling apparatus and proceeded to Rice's Landing. As the cold air and warmer water met, and fog began to form, a thin spray of oil and organic acid was spread over a broad area of the river. The fog dissipated rapidly. The oil prevented contact of the air and water.

Major J. Franklin Bell of the Federal Engineering Department, Dr. E. Ward Tillotson of the Mellon Institute and Dr. H. B. Meller, city smoke expert, were included in the party.

Another experiment, on a much broader scale, will be held soon.

The Right way is The Best way

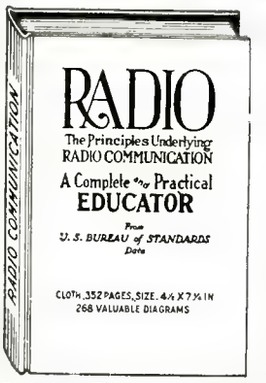
BUILD YOUR OWN SET

A short wave regenerative set, unassembled, for $15.00. This set is designed according to the "Radio Constructor Plan" No. 1 of the Consolidated Radio Call Book Co. Plans and instructions 50 cents extra. All parts furnished—all holes drilled—ready to be put together. Receives telephone broadcasting and wireless signals from 150 to 600 meters.

Material includes 43 plate variable condenser, dials, necessary wire, switch, knobs, switch points, binding posts, material for cabinet, "Radion" panel drilled ready for assembly. Illustration shows complete variometer for which tubes and all necessary parts are included. If wound coils are desired add $1.00.

All parts of the above R. C. No. 1 securely packed. Price **$15.00.**

The R. C. No. 1 will be neatly packed in special Christmas Boxes for those desiring to use the above set for the Holidays.


RADIO
The Principles Underlying RADIO COMMUNICATION
A Complete and Practical EDUCATOR
From U. S. BUREAU of STANDARDS Data
CLOTH, 352 PAGES, SIZE, 4¾ X 7¼ IN
268 VALUABLE DIAGRAMS
RADIO COMMUNICATION

The most complete and authoritative

Book on Radio

size: 4½ x 7¼ in.

Furnishes official and reliable radio data from the U. S. Bureau of Standards. Contains 352 pages filled with Radio meat. 268 diagrams and illustrations.

Includes Elementary Electricity for Radio Beginners, Dynamo-Electric Machinery, Radio Circuits, Electro Magnetic Waves, Transmitting and Receiving Apparatus, Crystal Detectors.

Bound in Full Cloth. **Only $1.00 postpaid.**

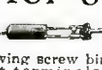
Order your copy today to insure prompt delivery. P. O. M. O. and Express M. O. acceptable.

Send for our catalogue

Fremont Radio Sales Co.
50 Church Street, N. Y. C.

A New Plug for 60c

No. 139—
All Terminal Plug—60c



Showing screw binding post terminals with phone cord tips inserted.

A handsome, highly finished, strong, light weight plug with conductive parts of machined brass. Handle is one piece and turned from solid insulating rod. Screw binding post terminals take cord-tips and terminals of all types. Adjustable brass thumb screws connect wire to plug and insure positive contact. Unnecessary to cut telephone tips. Not affected by body capacity and fits any standard jack.

Like Postage Stamps — Used Every Day — FROST RADIO

HERBERT H. FROST
NATIONAL FACTORY DISTRIBUTORS TO THE ELECTRICAL-RADIO JOBBER
154 W. LAKE ST. CHICAGO, ILL.

Wrestling Book FREE

Be an expert wrestler. Learn at home by mail. Wonderful lessons prepared by world's champions Farmer Burns and Frank Gotch. Free book tells you how. Secret holds, blocks and tricks revealed. Don't delay. Be strong, healthy. Handle big men with ease. Write for free book. State age.
Farmer Burns School, 1259 Railway Bldg. Omaha, Neb.

DICTOGRAPH *Radio* HEADSET

Was $12.00 NOW →

WHY THIS SENSATIONAL REDUCTION IN PRICE?

A sweeping cut of $4.00 in the price of the Dictograph Radio Headset! The tremendous endorsement of radio enthusiasts has made possible this sensational reduction. To meet the demand, production has been planned on a new, gigantic scale. Great manufacturing economies establish the new price—only $8.00, complete with 5 ft. cord.

A wonderful bargain! And above all, a wonderful headset—the world's standard of supreme quality for super-sensitive and accurate sound-transmission.

The same quality, the same guarantee, the same supreme Dictograph headset in every respect but the price. Type R-1, 3,000 ohms, for all types of receiving sets.

The Standard of the World

$20

DICTOGRAPH Radio LOUD SPEAKER

The Perfect Loud Speaker for the Home

Public demand has made possible the Dictograph Loud Speaker at the low price of only $20.00, complete with 5 ft. flexible cord. A handsome instrument that reproduces every sound in crystal-clear, natural tones, full volume, and free from distortion or noise. Ask for demonstration at reliable radio dealer's. A Suggestion: *here is the ideal Xmas Gift.*

DEALERS:—*Order through your jobber or write direct for names of authorized distributors*

Note:—Plans are now under way for the production of the new 4,000 ohms Dictograph SUPER-TONE Headset, the most perfect radio head set that can be made. For the most delicate work, the most exacting requirements. A new standard of super-sensitiveness! **List Price $12.00.**

DICTOGRAPH PRODUCTS CORPORATION

220 West Forty-Second Street **(Branches in all principal cities)** **New York, N. Y.**

The Radio Set Supreme

Will help to shorten the long evenings; it will keep you posted on daily sports, market reports, and other happenings; it will give you the chance to hear big political speeches in your own easy chair, it will bring the GRAND OPERA, the old-fashioned negro song, the peppy fox-trot, jazz, and entertainment to the family circle.

AERIAL-A

WESSCO QUALITY

A Vacuum Tube Receiving Set combines the highest form of mechanical construction with the utmost simplicity of operation.

Rich in appearance, compact, durable, it surpasses in selectiveness and beauty of tone instruments of many times its price.

BETTER THAN THE BEST

PRICE COMPLETE $35.00 (Including Phones, Tube, Aerial and Batteries)

Don't buy a Radio Set until you have seen and heard this one

Manufactured and sold by

W.E. Supply & Service Corp.

18 MURRAY STREET, NEW YORK CITY

Tele. BARCLAY 6151

HORNE
Radio Sets
and PARTS
Direct from the Nat'l Distributor

319 Loose Coupler	$7.50
300 V. T. Socket....65c—315 Variometer	3.90
330 Var. Condenser, Large 15 Plate	2.95
331 " " " 31 "	3.95
336 " " Small 21 "	2.45
337 " " " 43 "	3.45
341 " " in case with Dial 43-Plate	4.45
450 Audio Transf..$4.50—451 R. F. Transf.	3.50
460 Aerial Receptor Plug	1.50
H M 1 V. T. Tuner in Cabinet	20.00
H M 5 Detector in Cabinet	9.50
H M 6 Two Stage Amplifier	29.50
"VIRGINIS" Complete Vac. Tube Set for A. C. No Battery Required	49.00
"VENUS" Alternating Current Amplifier and Loud Speaker	49.00
Var. Coupler on Bakelite Panel with Dial and Switch Points	10.00
Variometer and Dial on Bakelite Panel	8.00
Var. Condenser and Dial on Bakelite Panel	7.50
Detector Unit to Match Above	8.00
Amplifier Unit to Match Above	13.50
Small Detector Unit	4.50
Small Amplifier Unit	10.00
Cabinets with Bakelite Panels:	
7 in.x7 in $3.75—7 in.x12½ in	5.50
7 in.x8 in 4.50—7 in.x16 in	6.50
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Wonders of the Sea

By A. P. PECK

(*Continued from page 746*)

again, until the picture is complete. It is necessary for her to carry down an eighteen pound lead weight, so that she may reach the bottom in the quickest possible time.

For the first time in the history of motion pictures slow motion photography was used under water. The effect was wonderful, as it showed the beautiful girl swimmer gracefully floating near the bottom of the sea among the weird ferns and other deep-sea growths. The schools of fish are very clearly shown in their patterned coloring, varied combinations of stripes and spots, and a living Conch is shown, ambling peacefully along the sand at the bottom of the sea.

While the party is at this place, the late Alexander Graham Bell, inventor of the telephone and other numerous devices, visited them, and descended into the tube, which he proclaimed to be the most wonderful thing he had ever seen. After revelling in the beauty of the scene, he reluctantly returned to the surface, and departed, warning the adventurers to look out for the dangers ahead.

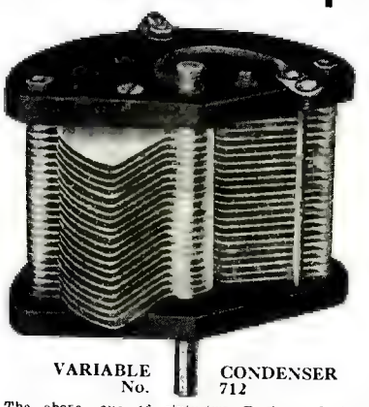
So the expedition starts for Treasure Island, and upon arriving, lowers the submarine apparatus directly over the place where the commotions had been seen. They make observations but can find no monsters, so Mr. Williamson and his expert diver Jack, don diving suits and descend in an endeavor to tempt the monsters into the open, so that they may be photographed.

Jack wears a new form of diving suit, which consists merely of a jacket and helmet and does not require any external air supply; the breath that he takes down with him, supplying him throughout his under-sea stay. The secret of this diver's suit lies in a new chemical, called oxylithe, through which he exhales and inhales. This chemical absorbs the poisons from the exhaled air, and restores oxygen to it, thereby making it again breathable. The only draw-back of this chemical is, that if water reaches it, it bursts into flame. The suit which Mr. Williamson wears is of the conventional diver's type, supplied with air by means of a flexible rubber tube extending to the surface, through which air is forced by means of a pump.

When the divers reach the bottom they encounter a strong current which they have to walk against. They make a very striking picture in their cumbersome diving suits, as they "lean" against the current at an angle of about 45 degrees, in an endeavor to make headway against it. They proceed toward several caves armed with nothing more than iron lances. On the way they encounter a "Moray," or poisonous eel, which they kill with the lance. As they approach the caves they hold a "conference" by "talking through their hats." That is, it is possible to converse with each other by touching their helmets together and talking, the voice vibrations setting up vibrations in their own helmet, which are transmitted to the helmet of the other diver who can readily hear them. They decide to go on, and as they reach the mouth of the cave an octopus' tentacle reaches out and grabs Jack's leg. They fight the monster who sends out great clouds of ink, completely engulfing the divers. Mr. Williamson frees Jack and relieves him of his lead weights, which allows him to float to the surface. Because of the impossibility of continuing the search in the inky waters Mr. Williamson also ascends to the surface.

Robbed of their prey because of the inky waters, the crew seeks revenge by attempting to catch a shark. They lower a monstrous hook, baited with a large chunk of meat on the end of a length of chain, which in turn is fastened to a long coil of heavy rope. In the under-sea chamber, watchers are able to see

Another Duck Triumph



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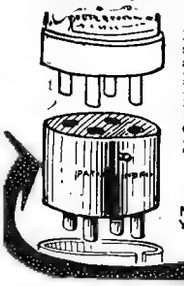

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the shark play with the bait and finally take it in his mouth and swallow it. A popular belief is exploded here, when they see the shark approach the bait and take it in his mouth without turning over. It is the idea of the general public that a shark necessarily has to turn over to bite, but this picture proves conclusively that this is not true. The shark is finally landed after a terrific battle, and the expedition is soon homeward bound, happy over their thrilling experiences.

TRANSFUSES BLOOD OF ANIMALS TO HUMANS

The claim is made by Dr. Cruchet, of Bordeaux, that he has succeeded in transfusing the blood of animals to human beings. The doctor also intimates that his discovery will rival in popularity the gland grafting of Dr. Voronoff. Patients, he declares, realize such remarkable effects from animal blood that they invariably ask to have the operation repeated.

The result claimed by Dr. Cruchet has been considered impossible by physicians. There is supposed to be an irreconcilable difference in the structure of the blood of animals and of man. The serum of animal blood in all experiments has destroyed the corpuscles of human blood.

Dr. Cruchet, stirred by the danger to patients in certain cases in European countries where there is no system, such as in America, of retained blood donors to be called by the hospitals in emergencies, turned to supply the deficiency. He started experiments by transfusing the blood of guinea pigs, dogs and cows to rabbits, then the blood of cows and sheep to dogs.

The transfusion blood contained 10 per cent of sodium citrate to prevent coagulation and according to the statements of the doctor the transfusion succeeded in thirteen out of sixteen cases.

Inspired by this success he next transfused a sheep's blood to human patients. The operation was followed by chills and slight fever, both of which quickly disappeared. The patients showed rapid improvement with the return of appetite and color. Dr. Cruchet states that he used sheep's blood only because it was convenient, and that the blood of a horse or other mammal would have done as well.

AVIATOR SAVES HIMSELF WITH PARACHUTE

Leaping from his Loening monoplane in a parachute when the plane began to wabble at a height of 2,000 feet over North Dayton, Ohio, Lieutenant Harold R. Harris, chief of the flying section of McCook Field, escaped death, while his plane crashed to earth.

The plane, landing in the rear yard of a home in that part of the city, was reduced to a mass of twisted wreckage. Lieutenant Harris came to earth several blocks away in a grape arbor.

He was traveling at high speed in the pursuit model when it got beyond control. He apparently realized that a fall was certain before he took to the parachute.

Harris won the commercial plane event in the Pulitzer races in Detroit, flying the "Honeymoon Express" plane.

Technical data, officials at McCook Field said, show that Lieutenant Harris's escape is the first time an air pilot has ever actually saved himself by use of a parachute.

A mail plane flyer leaped in a parachute over Chicago several years ago, but the necessity of leaving the plane that time was questioned by air service officials.

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Dr. Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(*Continued from page 750*)

fluence of a stimulant, I will promise you an interesting and instructive trip, and you will certainly see many new inventions, though I doubt if, on your return, you can make any profit out of them. At any rate, you will be back in an hour, so you risk nothing. Here, swallow down this potion, and while it is taking effect I will lead your mind in the right direction by speaking of some of the things you are likely to see."

* * *

"Where am I" cried Silas Rockett, opening his eyes and gazing about him in wonderment.

"I hope you are not hurt, sir?" said a soft feminine voice in his ear.

Silas Rockett looked up and found he was supported in the arms of a young girl about twenty, who was looking at him anxiously to ascertain if he were wounded.

"Where am I?" asked Silas again, his bewilderment increasing—"And who are you, pray?"

"My name is Radia Sparks, and here is my "identification button" FN-1728-N.Y. I suppose you flew here and met with an accident. By the way, you've lost your identification button!"

"My identification button? What's that?"

"Is it possible you don't know? I see from your clothing and speech that you are a stranger, but I thought everyone in the world today had to wear an identification button."

"What place is this?" asked Silas.

"This is New York City," returned the maiden.

"If you feel well enough to fly, I'll take you to my home, where you'll feel more comfortable. Have you your pocket-wings with you?"

"My pocket-wings?"

"Yes, to fly with? But I see you haven't them. Luckily, mine are strong enough to support the two of us." So saying, the young lady drew a roll from beneath her dress, unfolded it, and in a moment a small flying machine with a propeller underneath was ready for action."

"Where is the engine?" asked Silas in surprise.

"There is none. The power comes by wireless impulses from the earth, that set the propeller spinning. If we sit close together the two of us can fit in the machine. See, I turn this knob, and up we go?" And as she said the words the plane ascended in the air.

It was soon evident, however, that the weight of the two persons was too much for the machine.

"We shall have to land!" observed the young lady. "Luckily we are over the traveling walks?" A moment later the two found themselves on the roofs of the houses where three traveling sidewalks—if *side*walks they could be called—going at different rates of speed, were in constant motion in one direction, while three others were traveling in the reverse direction.

Silas and his fair companion moved from the slowest to the most rapid "walk" and there sat down in comfortable arm-chairs.

"Set your chair-dial for No 1272" said Radia, and she showed Silas how to turn the dials. "You see," she explained, "the chair is now set so it will travel straight to my house without further attention."

"Is all traveling done on the roofs of the houses?" asked Silas.

"Yes—The streets below are for the vehicular traffic. Here on the roof we have the gardens. And, as you see, at every street corner, our chairs cross from one block to the next on the moving bridges."

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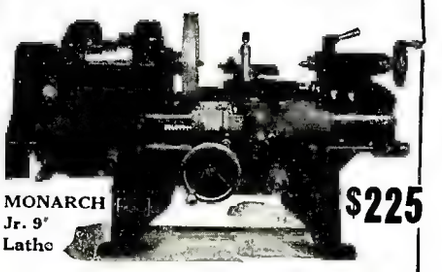

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"And are all the houses of the same height?"

"Practically so in all important centers in New York. Each house occupies a whole block, and surrounds a central garden. Roadways lead to this garden, for pleasure vehicles. All deliveries of goods are, however, made at the front door on the streets. Visitors either make use of the back doors in the garden, or enter from the traveling walks by doors in the roof, but they generally fly in through one of the windows."

"I see," said Silas. "By the way, what do you do when it rains? I suppose you have a glass roof to raise over the sidewalks, so you won't get wet?"

Radia turned and looked at him in surprise, and then laughed merrily. Why, what an idea!" she cried. "No, of course we have no glass roofs, though I believe there are such things in some out-of-the way countries. But we don't allow rain in the cities."

"You don't *allow* it?"

"No. The weather-makers have orders never to make it rain in New York except on special occasions. And then a week's notice must be given so people can remain at home during the shower.' '

"I see. Your weather is made to order. You have rain for the farmer and fine weather for the city man. But how do you satisfy everybody?"

"We don't. But we have local option. Every month the people of each locality decide by vote what weather they want for each day of the coming month—heat, cold, rain or shine—and they get what they want within certain reasonable limits and provided the expense is not too great."

"The expense?"

"Why, yes. It costs money to control the weather. It takes a large amount of power —in the form of heat or electricity, to bring down a shower, keep it off, or move it to some other locality. Of course, power is cheap—we get it from the waves, the tides, the heat of the sun, wind and the internal heat of the earth. But such large quantities are required for weather purposes that the cost is considerable. But here we are at home. See our chairs have stopped."

Silas looked all around him on the roof, but could perceive no sign of a door. Radia noticed his puzzled look, and gave a light silvery laugh.

"Wait until I open the door," she cried. And then, slowly and distinctly she pronounced the words:

"Open sesame!"

At the sound of her voice, a door in the roof noiselessly opened, and the arm-chairs on which they sat, automatically continued their journey.

"Was it the sound of your voice that opened that door?" asked Silas, puzzled.

"Why certainly," replied the young lady. "Almost all our locks are phonographic. We first make the record by speaking into the phonograph, and after that the lock will only open when the same voice repeats the same words, for unless the needle travels in the same groove, the electrical contact is not made, and the door will not open."

"But how do you manage when several persons are to use the same lock?"

"Each person makes his own phonogram, and the lock will then open to any one of a dozen different voices, each repeating its own special words. When strangers are expected we use a broader needle in making the records. Then the lock will open for anyone who pronounces the given words. Or else we speak through a special horn that changes the voice, so that the lock is not set for an individual voice."

"But doesn't your own voice change somewhat at times?"

"Yes indeed. Once I came home so hoarse that my voice wouldn't work the lock. In another case I had an attack of malaria and was shivering so hard I couldn't articulate the words. In both cases I had to hire a room downstairs until my family returned.

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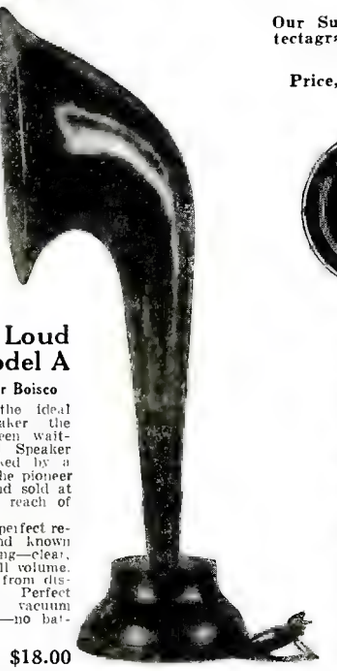

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The RADIO INDUSTRIES CORPORATION have been manufacturing their famous RICO TRIPOLE RECEIVERS for some time for radio purposes. These phones are made regularly for 2,000 and 3,000 ohms. There has, however, been a very large demand for a low-priced 75-ohm Receiver. The Corporation has finally decided to place one upon the market at a price that every one can afford.

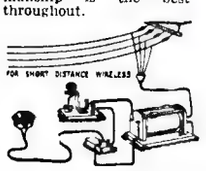
The illustration shows the exact size of this Receiver. It has practically the same materials and workmanship as that used in our expensive RICO radio head sets.

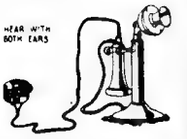
THE SPECIFICATIONS ARE AS FOLLOWS:

Aluminum Shell
Triple Pole Tungsten Magnet
Spool wound with Enameled Wire, 75 ohms
Bobbin Heads of Bakelite
Two Nickel-plated Binding Posts.
Hard Rubber Composition Cap
Non-rusting Sherardized Diaphragm

This is the Receiver for the Experimenter and Dabbler

This is THE Receiver for the experimenter and dabbler, and is far superior to any 75-ohm watch-case Receiver ever offered before. The magnetism of the tungsten magnet is so powerful that the entire Receiver can be lifted by its magnetism alone. The workmanship is the best throughout.





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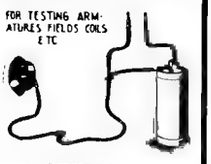

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But here we are in my room, and as you must be hungry, we might as well have some dinner."

Silas Rockett looked about him in surprise. The room was absolutely empty. In shape it was square, but there were no corners, no mouldings or panels to accumulate the dust. For ease in cleaning, the corners of the room were all rounded—there was no fire-place or mantel-piece and no carpet. Not even a door was visible. The arm-chairs, that had brought them, had vanished, and the opening had closed again. Not a chair, table, or other article of furniture was in sight. To Silas it appeared more like an empty room in a hospital than anything else.

"You have sanitary rooms all right," said he, "and they must be easy to keep clean."

"Yes, indeed," replied Radia, "the rooms scrub themselves clean every day, automatically."

"I see. But you speak of dinner, and yet there doesn't seem to be the ghost of a table, chair or stove present, and what is more important than all, there doesn't seem to be anything to eat."

Radia laughed again—and her laugh was so infectious that Silas found himself joining in, though he hadn't the faintest idea what he was laughing at.

"Before I attend to dinner," said Radia, "what kind of air will you have?"

"Air?" echoed Silas in perplexity.

"Yes. Do you want ocean breezes brought in from five hundred miles out in the Atlantic, or do you want mountain breezes from the Adirondacks?"

"Oh I see" said Silas "you bring your air to the houses in pipes."

"Yes," returned Radia. "Our houses are dustproof and we use only filtered air. And you can have it warm or cool—any temperature you wish."

"I'll try the ocean air," said Silas.

The young lady held herself erect, and in a clear distinct voice she uttered the command: "Sea breeze!"

Immediately the room was filled from an unseen source by the bracing salt-breezes of the Atlantic.

"You have good servants," observed Silas.

"Servants? Oh that was no servant that turned on the breeze. It was simply another phonographic lock. We have no servants but use phonographic locks instead. I can order any one of a thousand things by merely shouting the proper word. You see, this is my bedroom, dining-room, parlor, library, music-room, etc. The furniture is all of the folding variety and appears or disappears at command. It is stored behind the walls of the room. I shall now order the table and chairs to appear.

"Dining table for two!" she called. At the words the wall noiselessly opened and a small table with two chairs moved into the center of the room.

"Now," said Radia, "what will you have to eat. That round spot in the center of the table is a phonograph transmitter. Press the button in front of you to connect the instrument with the restaurant, and then order anything you want. It will be served immediately."

"I prefer that you should give the order," said Silas, diffidently.

Radia smiled and ordered a delicious dinner such as Silas in all his life had never tasted before. Each dish, as ordered, descended from the ceiling piping hot, and the young couple made a hearty meal.

"Now then," said Radia after the last mouthful had been eaten, "perhaps you would like to take a trip around the city. I have an extra pair of pocket-wings that you can use."

To Silas that afternoon spent in visiting the shops and factories was a revelation. He saw displays of goods such as he had never dreamt of before, and machines that possessed almost human intelligence so complex and delicate were the operations performed. Mankind, he found, had changed

but little in the hundred years, but mechanical inventions had multiplied to an enormous extent, and marvel after marvel appeared before his delighted eyes.

The clothing worn by the men and women especially interested him. It was soft like silk, and yet between the outer and inner airtight tissue there was a vacuum which served to keep out the *heat* in summer and the *cold* in winter.

He visited the schools, saw lessons in geography and history taught by speaking movies in natural colors. In physiology, too, the movies were used to show the functioning of each organ. The lectures that accompanied the movies were up-to-the minute talks by the most celebrated scientists.

The walls of houses were all built with a vacuum, and this acted as a silencer as well as a preservative against changes of temperature. A man could sing at the top of his voice, or run his phonograph at midnight in his room, and no sound would be perceptible to his neighbor in the next room.

He saw people walking across the Hudson River with their feet encased in weighted floating-shoes—what you might call water-skates. He saw other persons walk head-downward from a ceiling like flies, special suckers on their shoes enabling them to walk up the side-walls and cling to the ceiling. He greatly admired the lighting arrangements in the houses—for at the command: "Light!" the room would be flooded with daylight from some invisible source.

He flew to the suburbs with Radia and watched how the farmers passed the soil of their farms through sterilizing machines that killed all the weed-seeds and disease germs. Then pure cultures of beneficial microbes, and properly prepared humus and fertilizer were added, and the soil when planted, needed no weeding.

But it would be impossible to detail one one-hundredth of the things he saw. His head was in a perfect whirl as they turned to leave the farm.

"Ah Radia," said he, "I don't know how to thank you for this wonderful day." Then seeing that she was having some trouble with adjusting her flying-gear, he added: "Here—let me fasten your wings for you."

Radia looked superbly beautiful as she bent down to allow him to fasten the clasps of the aeroplane to her shoulders and it is no wonder if the poor man completely lost his head.

"Radia," said he with his soul in his eyes, "Radia, will you allow me to kiss you?"

"No indeed!" she replied, blushing. "Kissing is against the law. On account of sanitary reasons, no one is allowed to kiss." Then she added, more gently: "I have read about kissing, in books, and I have often wondered what it must feel like to have a man's lips touch yours!"

"I'll show you, Radia," cried Silas, beside himself, and seizing her in his arms he gave her a long ardent kiss.

The young girl blushed crimson, and breaking from his embrace, darted up into the air. In an instant Silas had buckled on his own flying machine and had followed her. But he had been too excited to fasten the clamps carefully. Something slipped and he felt himself falling, falling . . . .

* * *

"Well Silas," said Doctor Hackensaw—"You've been gone just one hour. I hope you've brought back enough ideas for inventions to make your fortune. But what in the world did you mean by crying out: 'Oh Radia, Radia—just one more kiss, please!'"

And Doctor Hackensaw smiled sarcastically.

Silas Rockett blushed scarlet. "Doctor," said he, "if you ever tell Gloria Mundy about Radia, I'll never forgive you. Women are such jealous creatures she wouldn't understand that Radia was only a girl one hundred years in the future—and a dream-girl at that!"

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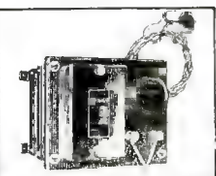

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Many houses claim that their orders are shipped within twenty-four hours. A year's record in our Order Department actually shows that over 99% of our orders leave within twelve hours after receipt. We invite you to try "RASCO" service on a 50c order. MAKE US PROVE WHAT WE SAY.

Sixty-eight per cent of all of our customers come back for more goods after they have tried our service once. The reason is very simple, as we specialize in very small orders. We could not stay in business if we had to look for new customers continually.

"RASCO" SERVICE IS WHAT COUNTS!

"Rasco" Catalog No. 8

The new "RASCO" catalog, No. 8, will prove a revelation to the man who "builds his own." In this catalog are listed more parts and more items than you have previously thought possible to obtain.

The new "RASCO" catalog contains over 500 different radio items, and has been greatly enlarged over the preceding one. IT NOW CONTAINS 64 PAGES, INSTEAD OF 40.

Price Reductions

Many items have been reduced to give our customers the benefit of the lower prices that enlarged production makes possible.

Factories in Brooklyn, N. Y., and Elkridge, Md.

These two factories, where our screw machine work, our stamping and our composition work is turned out, make it possible for us to offer the very lowest prices in the country.

75 Vacuum Tube Hook-Ups!

These hook-ups of ALL important vacuum tube connections are given in clear diagrams with complete explanations. This is the one and only catalog containing such a wealth of information on all Vacuum Tube sets, giving all the correct values of all the elements, so that any amateur can readily hook up a set with the instructions furnished.

All Armstrong Circuits: These important circuits are explained clearly, all values having been given, leaving out nothing that could puzzle you.

Just to name a few of the Vacuum Tube circuits: The V.T. as a detector and one-step amplifier; regenerative circuit; DeForest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one-step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; combination V.T. detector one stage amplifier; two stage radio frequency amplifier and detector with feedback coupling (regenerative); regenerative receiver, using single spider web coil; Armstrong super-regenerative circuit; two stage radio frequency amplifier coupled to a two-circuit tuner, using two-slide tuner regenerative receiver; two stage audio-frequency amplifier, using crystal or V.T.; one stage radio frequency detector, two stages audio-frequency with feed-back coupling to first tube; power amplifier with loud speaker; regenerative receiver and one stage amplifier for DX work; one stage radio frequency detector with feed-back coupling; very sensitive circuit with two stages of radio frequency and regenerative detector; one to ten mile radiophone transmitter; three stages radio frequency, two stages audio-frequency loop reception; crystal detector with rectification; one tube super-regenerative receiver; short ware regenerative receiver with two variocouplers, capacity-coupled tuner; trap circuit to eliminate interference; selective circuit to eliminate interference

In addition to all of this important information, we have added a section of important radio information, giving various tables, etc., for the benefit of the amateur.

For Special Clubs
Class No. 45

For Special Clubs
Class No. 50

For Special Clubs
Class No. 30

For Special Clubs
Class No. 60

With Hearst's International
Both to One Address
Class No. 105

For Special Clubs
Class No. 37

For Special Clubs
Class No. 50

Christmas Gifts for All

Give a subscription to your favorite magazines for Christmas. They make a most welcome, pleasing and appropriate gift and remain a gracious and constant reminder of the giver throughout the whole year. No other gift at such small expense can compare favorably with a yearly subscription to a few of your favorite magazines.

You can make your selection from the Radio specials or the attractive combinations listed on these two pages—or you can make up your own clubs from the magazines named and by adding the class numbers shown and multiplying the total by five, you will have the correct cost of your special club (see following example).

Example.—Suppose that you wish to subscribe to Radio News, Science & Invention and Boys' Life. Radio News is Class 45, Science & Invention is Class 45, and Boys' Life is Class 35, total 125. Multiplying by 5 equals 625. You remit $6.25, a saving of $0.75 over the regular subscription prices.

Should you wish to renew your own subscriptions, no matter when they expire, we will see that they are extended for the proper time.

Please do not wait for the last minute rush—send us your list now to insure arrival of the magazines by Christmas. We will enclose Christmas cards in your name if desired.

RADIO SPECIALS

Can be clubbed with any publication by using their class numbers as explained above.

Class Nos.	Magazine	Regular Price	Extra for Canada	Class Nos.	Magazine	Regular Price	Extra for Canada
45	**RADIO NEWS**	**$2.50**	**$0.50**	40	Q. S. T.	$2.00	$0.00
45	**SCIENCE & INVENTION**	**2.50**	**.50**	75	Scientific American	4.00	.50
45	Wireless Age	2.50	.50	50	Popular Science Monthly	2.50	.00

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Both **$4.00**
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People's Home Journal 1 25
Both **$2.75**
You Save $0.50
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(Continued next page)

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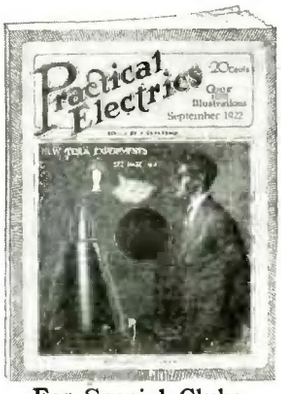

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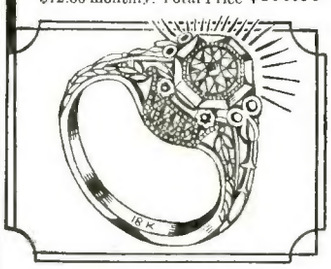

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¼ carat	$ 49.25	1¼ carat	$246.25
½ carat	98.50	1½ carat	295.50
¾ carat	147.75	1¾ carat	344.75
1 carat	197.00	2 carat	394.00

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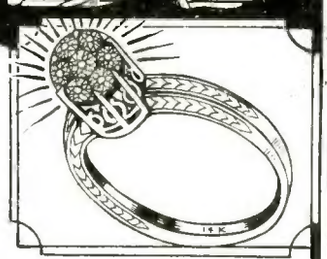

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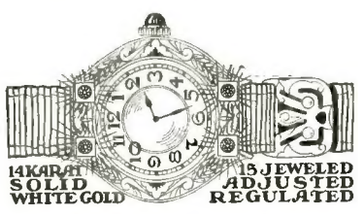

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FP 8—Finest quality La Helene pearls, guaranteed to be indestructible, never to crack, break, peel, discolor or wear-out for any cause. These beautiful pearls are perfectly graduated and matched. Each strand is 24 inches long, and is fitted with a genuine blue-white diamond clasp, fiery brilliant and perfectly cut.
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Arm Rocker is a massive, stately, comfortable piece, with beautifully designed back, wide, shapely arms, and smooth operating runners. Seat 19 x 17 1-2 in., height 36 in.

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